软件工程专业人才培养方案

Undergraduate Program for Software Engineering Major

学科门类：工学 　　　　　　　　　国标代码： 08

Discipline Type: Engineering 　　　　Code: 08

专业类：计算机类 　　　　　　　　　国标代码：0809

Type: Computer 　　　　　　　　　　Code: 0809

专业名称：软件工程 　　　　　　　　国标代码：080902 　　校内代码： 25

Title of the Major: Software Engineering 　　Code: 080902

一、学制与学位　　Length of Schooling and Degree

学制：四年 　　　　　　　Duration: Four years

授予学位：工学学士 　　　Degree: Bachelor of Engineering

二、培养目标　　Educational Objectives

培养服务于社会主义建设事业、德智体美劳全面发展、理论基础扎实、创新意识强、具有国际视野和发展潜力、具有终身学习意识，适应经济社会发展及未来需求变的，能源电力特色鲜明的多元化卓越人才。掌握自然科学和人文社科基础知识、计算机科学基础理论、软件工程专业知识，具有较强的软件开发能力、团队协作能力和项目管理能力，能够从事包括电力行业应用软件在内的复杂软件开发所涵盖的软件工程技术研究、设计、开发、管理和服务等方面的工作。

This major is targeted at cultivating outstanding talents with distinctive characteristics to serve socialist construction, who can make comprehensive development of morality, intelligence, physical education, art and labor, lay solid theoretical foundation, possess strong sense of innovation, a certain international vision and excellent development potential, adapt to economic and social development and future changes in requirements, as well as hold strong advantages in energy and power field.And the talents are supposed to master the basic knowledge of natural science, humanities and social science, basic theories of computer science, software engineering expertise as well as have strong capabilities in software development, possess collaboration skills and project management capabilities, and be able to engage in software engineering research, design, development, management and service covered by the development of complex softwares, including the application software in power industry.

学生毕业 5 年左右能够达到的职业和专业成就：

（1）具备较高的人文社会科学素养、社会责任感和工程职业道德，具备较丰富的工程经验，深入了解与软件工程领域相关的职业和行业的信息化需求，能提出专业的独立技术见解；

（2）具有灵活运用数学、自然科学以及经济、管理知识解决复杂工程问题的能力，精通计算机软件系统的研究、设计、开发及综合应用，能够成为软件研发项目的核心骨干或者管理人员；

（3）具有较为突出的创新能力，能够深入理解和准确评价复杂工程问题的工程实践对环境、社会可持续发展的影响，能够在综合考虑健康、安全、法律以及文化等因素的情况下进行大型工业软件以及电力行业应用软件等复杂软件系统的设计与开发；

（4）具备管理工作团队及协调项目活动的能力，能够组织制定工作计划并有效实施；能够就复杂工程问题与业界同行及社会公众进行有效的沟通和交流；

（5）具备终身学习的能力，能够应对科技发展挑战，掌握新兴技术，具备可持续发展理念和国际化视野，能够顺利进行跨文化的交流与合作。

Graduates are expected to have the following professional achievements after 5 years of work practice:

(1) They will have a higher humanities and social science literacy, social responsibility and engineering professional ethics, rich engineering experience, in-depth understanding of the information requirements of occupations and industries related to the software engineering field, and be able to propose professional and independent technical opinions;

(2) They will have the ability to flexibly use knowledge in mathematics, natural science, economics, and management to solve complex engineering problems, be proficient in the research, design, development and comprehensive application of computer software systems, and be able to become the core backbone or management personnel of software R&D projects;

(3) They will have a relatively outstanding ability in innovation, be able to deeply understand and accurately evaluate the impact of engineering practices of complex engineering issues on the environment and sustainable development of society, and be able to design and develop complex software systems such as large-scale industrial software and power industry application software in comprehensive consideration of health, safety, legal, and cultural factors;

(4) They will have the ability to manage work teams and coordinate project activities, be able to organize and formulate work plans and implement them effectively; be able to communicate with colleagues in the industry and the public effectively about complex engineering issues;

(5) They will have the ability to learn for life, be able to cope with the challenges of technological development, master emerging technologies, have the concept of sustainable development and an international vision, and be able to carry out cross-cultural exchanges and cooperation smoothly.

三、专业培养基本要求 Skills Profile

本专业学生毕业时应达到以下要求：

（1）工程知识：掌握从事本专业工作所需的数学、自然科学，以及经济学与管理学知识；系统掌握软件工程专业基础理论和专业知识，经历系统的专业实践，理解软件工程学科的基本概念、知识结构、典型方法；建立数字化、算法、模块化与层次化等核心专业意识，并能够用于解决理论和实践上的软件系统问题。

（2）问题分析：具有良好的科学素养和强烈的工程意识或研究探索意识，能够应用软件工程学科的基本思维方法和研究方法，综合运用所掌握知识、方法和技术解决复杂的工程问题及对结果进行分析的能力。

（3）设计/开发解决方案：能够进行计算机软件设计与开发，给出有效的解决方案；具有从事软件系统的分析、设计、应用和集成能力，并考虑法律、安全、环保和文化等因素。

（4）研究：能够基于科学原理和科学方法对软件工程学科问题进行研究，具有创新意

识，具备技术创新和产品创新的初步能力。

（5）使用现代工具：能够针对软件工程问题，选择适当的需求分析、软件设计、软件测试、软件构造以及软件部署等行业工具和其它信息技术工具。

（6）工程与社会：能够基于工程相关背景知识进行合理分析、评价软件工程专业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。

（7）环境和可持续发展：能够理解和评价针对复杂工程问题的软件工程实践对环境、社会可持续发展的影响。

（8）职业规范：具有人文社会科学素养和社会责任感，熟悉国家信息产业政策及国内外有关信息安全和知识产权的法律法规，在系统设计过程中能够综合考虑经济、环境、法律、法规、安全、健康、伦理等制约因素。

（9）个人和团队：能够在多学科背景下的团队中承担个体、团队成员以及负责人的角色，具有一定的软件工程项目组织管理能力、人际交往能力和团队合作能力。

（10）沟通能力：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；具有较好的外语应用能力，能阅读本专业的外文材料；并具备一定的国际视野，能够在跨文化背景下进行沟通、交流、竞争与合作能力。

（11）项目管理：理解并掌握软件项目管理原理与经济决策方法，并具有在多学科环境特别是电力领域中应用的能力。

（12）终身学习：具有终身学习意识以及运用现代信息技术获取相关信息和新技术、新知识的能力；具有自觉学习软件工程学科领域随时涌现的新概念、新模型和新技术，持续提高自己的能力。

Graduates are expected to acquire the following knowledge and abilities:

(1) Engineering knowledge: they should acquire the knowledge of mathematics and natural science, as well as economics and management required to work in this specialty. Master the basic theoretical knowledge and professional knowledge of software engineering systematically, as well as experience systematic professional practice, understand the basic concepts, knowledge structure, and typical methods of the software engineering discipline, establish core professional awareness of digitization, algorithms, modularization and hierarchy, and be able to use them to solve software system problems in theory and practice.

(2) Problem analysis: they are supposed to develop good scientific literacy and strong engineering sense or research and exploration sense, the ability to apply the basic thinking methods and research methods of software engineering disciplines, and the ability to synthesize and apply the knowledge, as well as methods and techniques acquired to solve complex practical problems and to analyze the results.

(3) Solutions design/development: they should be able to design and develop computer software, give effective solutions, and have the ability to engage in the analysis, design, application and integration of software systems, while taking legal, safety, environmental and cultural factors into account.

(4) Research: they should be able to carry out research related to software engineering discipline by scientific methods based on scientific principles with a sense of innovation, as well as possess the initial ability of technological innovation and product innovation.

(5) Modern tool usage: they should have the ability to select appropriate industry tools for requirement analysis, software design, software testing, software construction, and software

deployment and other information technology tools for software engineering problems.

(6) Engineer and society relations: they should have the ability to reasonably analyze and evaluate the social, health, safety, legal, and cultural impacts of professional software engineering practices and solutions to complex engineering problems based on engineering-related background knowledge, and they should understand the responsibilities involved.

(7) Environment and sustainable development: they should have the ability to understand and evaluate the impact of professional software engineering practices for complex engineering problems on environmental and social sustainable development.

(8) Professional standard accomplishment: they should have humanities and social science literacy, social responsibility, be familiar with national information industry policies as well as domestic and foreign laws and regulations on information security and intellectual property, and be able to consider economic, environmental, legal, regulatory, security, health, ethical and other constraints in the system design process.

(9) Individual and team competence: they should have the ability to assume the role of individual, member and leader of a team in a multidisciplinary context, and possess organization and management skills in software engineering project, as well as interpersonal skills and teamwork skills.

(10) Communication: they should have the ability to communicate effectively with industry peers and the public on complex engineering issues, including writing reports, designing presentations, making statements, and articulating or responding to instructions; possess good foreign language skills and ability to read foreign language materials in the field; hold a certain international perspective, and have the ability to communicate, exchange, compete and cooperate in a cross-cultural context.

(11) Project management: they should have the ability to understand and master the principles of software project management and economic decision-making methods, and be able to apply them in a multidisciplinary environment, especially in power applications.

(12) Lifelong learning: they should have the sense of lifelong learning and the ability to use modern information technology to obtain relevant information as well as new technologies and knowledge, consciously learn new concepts, new models and new technologies that emerge in the field of software engineering at any time, and continuously improve their abilities.

四、学时与学分　　Hours and Credits

类别		学时	学分	比例
必修课 Required courses	公共基础 Public infrastructure	644	33	19.47%
	学科门类基础 Basis of discipline	576	36	21.24%
	专业类基础 Basis of major	488	30.5	17.99%
	专业核心 Required courses of major	192	12	7.08%
	集中实践 Intensive practice	208 学时+21 周 208 class hours +21 weeks	33	19.47%
必修课小计 Subtotal of Required courses		2108 学时+21 周 2108 class hours + 21 weeks	144.5	85.84%
选修课 Electives		320	20	11.80%

类别	学时	学分	比例
课外实践学分 Practice credits of extra-curricular	5 周 5 weeks	5	2.95%
总计 Total	2428 学时+26 周 2428 class hours + 26 weeks	169.5	100%

说明：

必修实践环节学分包括：集中实践课程 33 学分，课外实践课程 5 学分，学科门类基础、专业基础课程中的实验课程 4 学分，学科门类基础、专业基础、专业必修课程中的实验、上机学时折算 1 学分，共计 43 学分，占总学分 25.37%。

Note:

Total of 43 credits for required practice training, accounting for 25.37% of the total credits, including: 33 credits for Intensive practice, 5 credits for practice credits of extra-curricular, 4 credits for basis of discipline and basis of major, 1 credit for experiment and computer practice in basis of discipline, basis of major, and required courses of major.

五、专业主干课程 Main Course

离散数学、数据结构、面向对象程序设计、操作系统、数据库原理、编译技术、计算机网络、计算机组成原理、软件工程、软件体系结构、软件构造、软件测试与质量保证、软件项目管理。

Discrete Mathematics, Data Structures, Object-Oriented Programming, Operating Systems, Database Principles, Compiling Techniques, Computer Network, Principles of Computer Composition, Software Engineering, Software Architecture, Software Construction, Software Testing and Quality Assurance, Software Project Management。

六、总周数分配   Arrangement of the Total Weeks

学期 Semester 教学环节 Teaching Program	一	二	三	四	五	六	七	八	合计
理论教学 Theoretic Teaching	17	16	16	17	16	16	17	2	118
复习考试 Review and Exam	2	2	1	1	1	1	3	0	11
集中实践环节 Intensive practice	3	2	3	2	5	2	1	16	33
小计 Subtotal	22	20	20	20	22	19	21	18	162
寒假 Winter Vacation	5		5		5		5		20
暑假 Summer Vacation		6		6		6			18
合计 Total	27	26	25	26	27	25	26	18	200

软件工程专业必修课程体系及教学计划

Table of Teaching Schedule for Required Course and Teaching Plan

类别 Type	课程编号 Course ID	课程名称 Course name	学分 Credits	总学时 Hours	课内学时 In class hours	实验学时 Lab hours	课外学时 Off class hours	开课学期 Semester
公共基础类课程 Public basic courses	00700975	中国近现代史纲要 Outline of Modern Chinese History	3	48	32		16	2
	00701353	思想道德与法治 Ideology and Moral Cultivation & Law Basis	3	48	32		16	1
	00700983	毛泽东思想和中国特色社会主义理论体系概论 Mao Zedong Thought and the theory of building socialism with Chinese Characteristics	3	48	32		16	3
	00700971	马克思主义基本原理 Marxist theory	3	48	32		16	3
	00700988	习近平新时代中国特色社会主义思想概论	3	48	32		16	2
	00701661-00701668	形势与政策 Current Events and Policy	2	64	64			1-8
	01390011	军事理论 Military Theory	2	36	24		12	1
	J100010	现代电力工程师	2	32	32			2
	00801410	通用英语 General English	4	64	64			1
	00801400	学术英语 Academic English	4	64	64			2
	01000011	体育(1)Physical Education (1)	1	36	30		6	1
	01000021	体育(2)Physical Education (2)	1	36	30		6	2
	01000031	体育(3)Physical Education (3)	1	36	30		6	3
	01000041	体育(4)Physical Education (4)	1	36	30		6	4
		公共基础课程小计 Subtotal of public basic courses	33	644	528		116	
学科门类基础课程 Basis of discipline	00900130	高等数学（1） Advanced Mathematics (1)	5.5	88	88			1
	00900140	高等数学（2） Advanced Mathematics (2)	6	96	96			2
	00900462	线性代数 Linear Algebra	3	48	48			3
	00900111	概率论与数理统计 Probability and Mathematical Statistics	3.5	56	56			4
	00900053	大学物理(1) College Physics (1)	3.5	56	56			2

类别 Type	课程编号 Course ID	课程名称 Course name	学分 Credits	总学时 Hours	课内学时 In class hours	实验学时 Lab hours	课外学时 Off class hours	开课学期 Semester
	00900064	大学物理(2) College Physics (2)	3	48	48			3
	00900440	物理实验(1) Experiments of Physics (1)	2	32		32		2
	00900450	物理实验(2) Experiments of Physics (2)	2	32		32		3
	04100300	高级语言程序设计 Advanced Language Programming	3.5	56	56			1
	04101700	计算机导论 Introduction to Computer Science	1	16	16			1
	10410221	面向对象程序设计 Object-Oriented Programming	3	48	40	8		3
	学科门类基础课程小计 Subtotal of Engineering foundation		36	576	504	72		
专业基础类课程 The major basic courses	00600460	离散数学 Discrete Mathematics	4	64	64			1
	00600600	数据结构 Data Structure	3.5	56	56			2
	10410160	计算机网络 Computer Network	3	48	48			3
	10410971	汇编语言程序设计 Assembly Language Programming	2	32	32			4
	00600651	数字逻辑与数字系统设计 Design in Digital Logic and Digital System	3	48	48			4
	00600660	算法设计与分析 Algorithm Design and Analysis	3	48	40	8		4
	00600100	操作系统 Operating Systems	3.5	56	56			4
	10410560	计算机组成原理 Principles of Computer Composition	3.5	56	56			5
	00600091	编译技术 Compiling Techniques	2.5	40	40			5
	00600621	数据库原理 Database Principles	2.5	40	40			5
	专业基础类课程小计 Subtotal of The major basic courses		30.5	488	480	8		
专业核心课程 Required courses of major	00600542	软件工程 Software Engineering	3	48	48			5
	00600531	软件测试与质量保证 Software Testing and Quality Assurance	2	32	32			6
	00600571	软件体系结构 Software Architecture	2.5	40	40			6

类别 Type	课程编号 Course ID	课程名称 Course name	学分 Credits	总学时 Hours	课内学时 In class hours	实验学时 Lab hours	课外学时 Off class hours	开课学期 Semester
	10141030	软件构造 Software Construction	2	32	32			6
	00600581	软件项目管理 Software Project Management	2.5	40	40			7
		专业核心课程小计 Subtotal of Required courses of major	12	192	192			
必修课学分合计 Subtotal of Required courses			111.5					

软件工程专业部分集中实践环节设置
Table of Teaching Schedule for Main Practical Training

类别 Type	课序号 ID	环节名称 Name	学分 Credits	周数 Weeks	学时数 Hours	开课 学期 Semester
必修 Required	01390012	军事技能 Military Training	2	2		1
	00690092	程序设计实验 Programming Experiments	1	1		1
	00690210	数据结构课程设计 Course Project of Data Structure	1	1		2
	00690130	认识实习 Acquaintanceship Practice	1	1		2
	00690290	计算机网络综合实验 Experiment of Computer Network	1	1		3
	00690380	数字逻辑与数字系统设计综合实验 Experiment of Digital Logic and Digital System Design	1	1		4
	00690061	操作系统综合实验 Experiment of Operating Systems	1	1		4
	00690190	数据库原理课程设计 Course Project of Database Principles	1	1		5
	00690160	软件工程综合实验 Experiment of Software Engineering	2	2		5
	00690040	编译技术课程设计 Course Project of Compiling Techniques	1	1		5
	10410569	计算机组成原理综合实验 Experiment of Computer Composition Principles	1	1		5
	00690250	软件测试与质量保证课程设计 Course Project of Software Testing and Quality Assurance	1	1		6
	00690260	软件体系结构综合实验 Experiment of Software Architecture	1	1		6
	00690780	软件项目管理综合实验 Experiment of Software Project Management	1	1		7
	00690031	毕业实习 Graduation Practice	2	2		8
	00690021	毕业设计 Graduation Project	13		208	7-8
	J100060	劳动教育 Labor Education	2	2 周		3
	00690010	毕业教育 Graduation Education	0	1		
集中实践小计 Subtotal of major practical training			33	21	208	

软件工程专业选修课教学进程

Table of Teaching Schedule for Electives

选修课程分为专业领域课程、其它专业课程、通识教育课程 3 个部分，总学分不低于 20 学分。其中，专业领域课程和其它专业课程学分不低于 12 学分。学生可根据自身情况、兴趣爱好等进行选课。

Elective courses are divided into 3 parts: major courses, general education courses, other major courses. The total elective credits are not less than 20 credits total credits, and the total courses including major courses and other major courses are not less than 12 credits total credits. Students can choose courses according to their own situation and interests.

1．专业领域课程 Major field courses

专业领域课程旨在培养学生在该专业某领域内具备综合分析、处理（研究、设计）问题的技能及专业前沿知识。本专业领域的选修课程如下表所示。

Major field courses aim to develop students' skills and advanced knowledge of comprehensive analysis, processing (research, design) problems in a certain field of the major. Elective courses in this field are shown in the following table.

2．其他专业课程 Other major courses

为了培养复合型人才，鼓励学生跨专业选修课程。学生可以选修我校开设的任何专业的课程。

In order to cultivate compound talents, students should be encouraged to cross major elective courses. Students can take any courses offered by our university.

3．通识教育课程 General education curriculum

通识教育课程包括人文社科、语言交流、文化艺术、科学技术、经济管理、创新创业等模块，学生从学校给定的通识教育课程中选择。

General education curriculum includes humanities and social sciences, language communication, culture and art, science and technology, economic management, innovation and entrepreneurship modules. Students choose from general education courses offered by the university. The courses "Introduction to environmental protection and sustainable society" and "Engineering Project Management" are suggested to be selected.

组别		课程编号	课程名称	学分	总学时	课内学时	实验学时	课外学时	开课学期	模块
1	模块1	00600063	C++程序设计 Programming in C++	2	32	32			4	各模块课程须绑定选取。总学分不少于12学分 Electives, not less than 12 credits
		00600950	软件人机界面设计 Design of Software Human-Machine Interface	2	32	32			4	
		00601671	Python语言高级编程 Advanced Programming in Python	2	32	32			5	
		00601090	分布式系统与云计算 Distributed System and Cloud Computing	2	32	32			5	
		00601740	Web智能编程与应用 Web Intelligent Programming and Application	2	32	32			5	
		00600561	软件中间件技术及应用 Technology and Application of Software Middleware	2	32	32			6	
		10141040	科技论文写作 Research & Engineering Paper Writing	0.5	8	8			7	
	模块2	00601460	智能信息处理 Intelligent Information Processing	2	32	32			5	
		00600040	LINUX体系及编程 LINUX Architecture and Programming	2	32	32	8		6	
		10141050	智能计算方法及应用 Intelligent Computing Method and Application	2	32	32			6	
		00601500	电力大数据分析与应用 Big Data in Electric Power Industry	1.5	24	24			6	
		00600821	专业英语阅读(软件) Specialty English for Software	2	32	32			6	
		00601540	深度学习 Deep Learning	2	32	32			6	
		00601010	数据仓库与数据挖掘 Data Warehouse and Data Mining	2	32	32			5	
	模块3	00600521	人工智能及应用 Artificial Intelligence and Application	2	32	32			4	
		00400310	数字图像处理 Digital Image Processing	2	32	32			4	
		00600361	计算机图形学 Computer Graphics	2	32	32			5	
		00600770	虚拟现实 Virtual Reality	2	32	32			5	
		00601340	机器学习 Machine Learning	2	32	32			5	
		00400311	图像处理与计算机视觉 Computer Vision	2	32	32			6	
	模块4		跨专业选修其他专业的专业课程 Interdisciplinary Electives							
2			通识教育选修课程 General Education Electives							公共艺术类课程至少

组别	课程编号	课 程 名 称	学分	总学时	课内学时	实验学时	课外学时	开课学期	模块
									选修2学分；其它可用组别1中课程学分替代
选修课总学分不低于20学分。其中，组别1中的专业领域课程和其它专业课程学分不低于12学分。									

选修课选课建议：Recommendations for electives

1.第二、第三学期：建议每学期选修通识教育选修课程模块中的课程1-2门。

2.第四、五、六、七、八学期：建议每学期从专业选修课各模块中选修1-3门课程；也可根据个人兴趣，跨专业选修其他专业的专业课程。

1. Second and third semesters: It is recommended to select 1-2 courses in **General Education Electives** every semester.

2. Fourth, fifth, sixth, seventh, and eighth semesters: It is recommended to choose 1-3 courses from each part of electives each semester; you can also select **Interdisciplinary Electives** based on personal interests.

辅修软件工程专业人才培养方案

Undergraduate Program for the Automation Minor

课程编号	课程名称	学分	总学时	课内学时	实验学时	开课学期	备注
00600460	离散数学 Discrete Mathematics	4	64	64		1	
00600600	数据结构 Data Structure	3.5	56	56		2	
00600100	操作系统 Operating Systems	3.5	56	56		4	
10410560	计算机组成原理 Principles of Computer Organization	3.5	56	56		5	
00600621	数据库原理 Database Principles	2.5	40	40		5	
10410160	计算机网络 Computer Network	3	48	48		3	
00600542	软件工程 Software Engineering	3	48	48		5	
00600571	软件体系结构 Software Architecture	2.5	40	40		6	
00600581	软件项目管理 Software Project Management	2.5	40	40		7	
00600531	软件测试与质量保证 Software Testing and Quality Assurance	2	32	32		6	
10141030	软件构造 Software Construction	2	32	32		6	
学分合计 Subtotal of courses		32	512	512			

说明：辅修专业总学分 25-30 学分。