Data Science and Big Data Technology

(Grade 2022)

Course code: 080910T

I. Cultivation Objectives

1. General cultivation objective

The Program of Data Science and Big Data Technology adheres to the school's direction, market demand and employment orientation education, in order to cultivate students' scientific computing ability, data analysis, processing and application ability, practical and innovative ability. Graduates should be healthy in character, have a scientific humanistic spirit, innovative and entrepreneurial spirit and good professional ethics; they should have the ability to learn independently and to think computationally. Graduates will master the basic theories and fundamental knowledge required for big data science and technology, and master the core technologies and basic skills in the field of big data technology. This program cultivates high quality application-oriented engineering and technical talents who can serve in the field of big data application and be competent in big data engineering development, big data analysis and processing, management and maintenance of big data systems.

2. Objective of value guidance

With core values of socialism as the core, the aim is to cultivate engineering and technology application-oriented talents who can adapt to the development of society. Combining with humanities and social science courses, in the implementation of professional courses, especially practice courses, this program cultivates students to have the ability to develop, analyse and process big data, be able to manage and maintain big data systems, have an international perspective and craftsman spirit, have the core values of socialism, and cultivate students to become a useful person with both moral and intellectual abilities.

3. Five years after graduation, students in this program should achieve the following objectives:

(1) Have a sense of social responsibility and good professional ethics, and be able to integrate the impacts of legal, environmental, social, cultural and sustainable development factors in their engineering practice.

(2) Have a basic understanding of the international status of Data Science and Big Data Technology and its related fields, and be able to communicate and interact in a cross-cultural context. Be able to acquire an consciousnesses and ability to innovate in engineering through the completion of innovative practical courses.

(3) Should master the comprehensive multidisciplinary knowledge required in the field of Data Science and Big Data Technology, have the ability to analyze and solve complex engineering problems in related fields, and be able to model, analyze, design and apply engineering problems using Data Science and Big Data Technology methods, and optimize the models through analysis of experimental results. Have ability to work on product development, technology application, analysis, decision making and maintenance in fields related to Big Data Technology.

(4) Possess an innovative spirit and an international perspective. Have knowledge of at least one foreign language, a healthy body and mind and good humanities and scientific literacy, and have team spirit and good communication, coordination, cooperation, competition and engineering Project Management skills.

(5) Possess the consciousnesses and ability of independent and lifelong learning, and be able to adapt to changes in scientific and technological progress and the needs of social and economic development. Through innovative practical projects and enterprise internships, students will be able to recognize and understand the characteristics

of the Data Science and Big Data Technology field, which is characterized by rapid knowledge renewal and the emergence of new technologies and methods, and establish stable career goals.

II. Graduation requirements

1. engineering knowledge: Have the ability to apply mathematical, natural science and engineering fundamentals and professional knowledge to the solution of complex engineering problems.

1-1: Be able to apply techniques from the fields of mathematics, natural sciences, engineering sciences and Data Science and Big Data Technology to the formulation of complex engineering problems.

1-2: Be able to develop mathematical models and solve them for specific objects in complex engineering problems.

1-3: Be able to apply relevant knowledge and mathematical modelling methods to the reasoning and analysis of complex engineering problems.

1-4: Be able to apply relevant knowledge and mathematical modelling methods to the integrated design and comparison of solutions to complex engineering problems.

2. Analysis of the Problem: Have the ability to apply the fundamental principles of mathematics, natural and engineering sciences to identify, represent and analyse complex engineering problems through literature research in order to reach valid conclusions.

2-1: Be able to identify and judge the key aspects and factors of complex engineering problems based on relevant scientific principles.

2-2: Be able to express complex engineering problems correctly using relevant scientific principles and analytical methods.

2-3: Be able to recognize that there are multiple options available for solving problems, to conduct literature research for alternative solutions using a variety of resources and tools, and to synthesize and select appropriate solutions.

2-4: Be able to analyse influencing factors and draw valid conclusions by applying basic principles, drawing on literature research or other methods.

3. Design/develop of solutions: Have the ability to design solutions to complex engineering problems, to design and develop reusable Big Data analytics modules/components that meet specific needs, and to demonstrate innovation in the design process, taking into account social, health, safety, legal, cultural and environmental considerations.

3-1: Knowledge of basic design/development methods and techniques for big data analysis and processing frameworks, and understanding of the factors that influence design objectives and technical solutions.

3-2: Be able to complete the design, implementation and testing of modules/components for specific requirements.

3-3: Ability to develop a system design for a specific need and to demonstrate a sense of innovation in the design.

3-4: Be able to consider social, health, safety, legal, cultural and environmental factors in the design of systems.

4. Problem Research: Have the ability to apply scientific principles and methods to complex engineering problems, including designing experiments, analyzing and interpreting data, and synthesizing information to reach reasonable and valid conclusions.

4-1: Be able to analyse solutions to complex engineering problems based on scientific principles and data science related principles and methods.

4-2: Be able to Select a route of research and designing an experimental program based on the characteristics of the problem.

4-3: Be able to construct experimental systems to carry out experiments according to experimental protocols and to obtain valid experimental data.

4-4: Be able to analyse and interpret experimental data and synthesize information to reach reasonable and valid conclusions.

5. Use of modern tools: Have the ability to develop, select and use appropriate technologies, resources, modern engineering tools and information technology tools for complex engineering problems, including the analysis, design, development, prediction, simulation and testing of big data analysis and processing software and platforms, and the ability to understand their limitations.

5-1: Have knowledge of the principles and methods of using modern engineering and information technology tools commonly used in the field of Data Science and Big Data Technology, and an understanding of their limitations.

5-2: Be able to select and use appropriate technologies, resources, modern engineering tools and information technology tools to complete the analysis, design and development of systems.

5-3: Be able to develop or select modern tools to meet the requirements for specific objects, simulate and test systems, predict operational effects and be able to analyse their limitations.

6. Engineering and Society: Have the ability to undertake sound analysis based on background knowledge of Data Science and Big Data Technology, evaluate the social, health, safety, legal and cultural impacts of engineering practices and solutions to complex engineering problems, and understand the responsibilities involved.

6-1: Understand the technical standards system, intellectual property rights, industrial policies and laws and regulations in the field of Data Science and Big Data Technology, and understand the impact of different social cultures on Software Engineering activities.

6-2: Be able to analyse and evaluate the social, health, safety, legal and cultural impacts of solutions to complex engineering problems and the impact of these constraints on project implementation, based on practical application scenarios, and understand the responsibilities involved.

7. Environment and Sustainable Development: Have the ability to understand and evaluate the environmental and social sustainability impacts of engineering practices for complex engineering problems.

7-1: Have Knowledge and understanding of the concepts and impacts of environmental protection and sustainable development related to the engineering practice of complex engineering problems.

7-2: Be able to think about the sustainability of solutions to complex engineering problems in terms of environmental protection and sustainable development, and to evaluate the potential damage and hazards to people and the environment in the context of practical application scenarios.

8. Professional Codes: Have good humanities and scientific literacy, social responsibility and the ability to understand and comply with engineering ethics and codes of practice and responsibilities in the practice of Software Engineering.

8-1: Be able to build and practise the core values of socialism, understand the relationship between the individual and society, understand the national conditions of China and clarify the responsibilities and missions of the individual as a builder and successor of the socialism cause.

8-2: Understand the software engineering ethics and codes of integrity and honesty, and be able to consciously follow them in engineering practice.

8-3: Understand the engineer's social responsibility for the safety, health and well-being of the public, and for environmental protection, and be able to exercise this responsibility consciously in the practice of engineering.

9. Individual and team: Have the ability to assume the role of individual, team member and leader of a team in a multidisciplinary context.

9-1: Be able to understand the meaning of teamwork in a multidisciplinary context and be able to communicate effectively and work cooperatively with members of other disciplines.

9-2: Be able to perform the role of team member or leader depending on the team role: as a team member should be able to work independently or collaboratively within the team; as a team leader should be able to organise, co-ordinate and direct the work of the team.

10. Communication: Have the ability to communicate effectively with industry peers and the public on complex engineering issues, including writing reports and design briefs, presenting statements, articulating or responding to instructions, and having an international perspective and the ability to communicate and interact in a cross-cultural context.

10-1: Have excellent verbal and written communication skills with the ability to clearly and accurately express ideas, respond to challenges verbally, in writing, and in diagrams, and understand the differences in communication with industry peers and the public on complex Software Engineering issues,.

10-2: Understand and follow international trends and research hotspots in the field of Data Science and Big Data Technology, and understand and respect the differences and diversity of different cultures around the world.

10-3: Demonstrated verbal and written skills in cross-cultural communication and the ability to communicate and interact in a basic manner in a cross-cultural context on complex engineering issues.

11. Project Management: Understand and master the principles of complex engineering management and economic decision-making methods, and apply them in a multidisciplinary environment.

11-1: Be able to understand the full process of developing big data analysis and processing systems and understand engineering management and economic decision-making issues.

11-2: Be able to master the management and economic decision-making methods involved in engineering projects and to apply them in the design and development of solutions in a multidisciplinary environment, including simulation.

12. Spirit and ability of lifelong learning: Have a sense of independent and lifelong learning, with the ability to learn and adapt to development.

12-1: Be able to recognize the need for lifelong and independent learning in the wider context of social development.

12-2: Have the ability to learn independently, including the ability to understand technical issues, to summarize and to ask questions.

III. Schooling System

Four years.

IV. Length of Study

Flexible study period, generally four years, the minimum length of flexibility is not less than three years, the

longest not more than six years.

V. Requirements for Graduation and Degree Conferring

In order to graduate, students must complete the minimum number of credits required by the Instructive Cultivation Plan for each course category and all the content required by the Extracurricular Class, with a total of 162 credits, and will be awarded a Bachelor of Engineering degree if they meet the requirements for the award of a Bachelor's degree.

VI. Discipline

Software Engineering, Computer Science and Technology.

VII. Core Courses

Probability Theory and Mathematical Statistics, Foundations of Statistics, Fundamentals of Programming, Data Structures and Algorithms, Introduction to Database Systems, Algorithm Design and Analysis, Machine Learning, Distributed Computing, Cloud Computing and Data Centers, Integrated Design for Intelligent Analysis of Massive Data, Integrated Design for Open Source Software Development for Big Data.

VIII. Course Structure and Course Hours (excluding Extracurricular Class)

Category	**Total Credit**	**%**	**Total Course Hours**	**Theory Learning**	**Practical Training**
Public Fundamental Course	57.5	36	1056	976	80
General Education	10	6	160	160	0
Engineering Fundamental Course	4	2	64	64	0
Professional Fundamental Course	30	19	480	384	96
Professional Course	34	21	544	391	153
Professional Practice	25.5	16	760	0	760
Total	161	100	3064	1975	1089
Theory: **Practical** (%)	64:36				

IX. Teaching schedule (1)

Category	Type	Provided by	Course Code	Course Name	Assessment	Credit	Course Hours	Theory Learning	Practical Training	Recommended semester
Public Fundamental Course	required	School of Marxism	b1080001	Basic Principles of Marxism	test	3	48	42	6	Spring 1
	required	School of Marxism	b1080009	Ethics and the Rule of Law	non-test	3	48	42	6	Spring 1
	required	School of Marxism	b1080006	Outline of Modern Chinese History	non-test	3	48	42	6	Autumn 1
	required	School of Marxism	b1080004	Introduction to Mao Zedong Thought and the Theoretical System of Socialism with Chinese Characteristics I	test	3	48	42	6	Autumn 2
	required	School of Marxism	b1080007	Introduction to Mao Zedong Thought and the Theoretical System of Socialism with Chinese Characteristics II	test	2	32	28	4	Spring 2
	required	School of Marxism	-----	Situation and Policy (Modules 1 to 4)	non-test	2	32	28	4	Autumn 1 to Spring 2
	required	School of Marxism	b1080008	Labour Education A	non-test	0.5	16	16		Autumn 2
	required	College of Arts and Sciences	b1020112	Advanced Mathematics D1	test	5	80	80		Autumn 1
	required	College of Arts and Sciences	b1020113	Advanced Mathematics D2	test	5	80	80		Spring 1
	required	College of Arts and Sciences	b1020108	Linear Algebra	test	3	48	48		Autumn 1
	required	College of Arts and Sciences	b1020114	Probability Theory and Mathematical Statistics	test	3	48	48		Spring 1
	required	Others	b1110004	Mental Health Education for University Students	non-test	2	32	16	16	Spring 1
	required	College of Arts and Sciences	b1020018	Academic Chinese	non-test	2	32	32		Spring 1
	required	College of Arts and Sciences	b1020063	Academic Physics A (Module 2)	test	3	48	48		Spring 1
	required	College of Arts and Sciences	b1020065	Academic Physics B	test	2	32	32		Autumn 2
	required	College of Arts and Sciences	b1020111	Academic Physics C	non-test	2	32		32	Autumn 2
	required	College of Physical Education	-----	Physical Education I to VI	non-test	3	160	160		Autumn 1 to Autumn 4
	required	Others	b1110003	Military skills	non-test	0.5	2W			Autumn 1
	required	College of Arts and Sciences	b1110002	Military theory	non-test	0.5	32	32		Autumn 2
	★Academic English (Select 1module for 10 credits)	Module A	b1020003	General English III	test	3	48	48		Autumn 1
			b1020004	General English IV	test	3	48	48		Spring 1
			b1020005	Academic English A	test	2	32	32		Autumn 2
			---	Foreign Language Expansion	non-test	2	32	32		Spring 2
		Module B	b1020002	General English II	test	3	48	48		Autumn 1
			b1020003	General English III	test	3	48	48		Spring 1
			b1020006	Academic English B	test	2	32	32		Autumn 2
			---	Foreign Language Expansion	non-test	2	32	32		Spring 2
		Module C	b1020001	General English I	test	4	64	64		Autumn 1
			b1020002	General English II	test	3	48	48		Spring 1
			b1020003	General English III	test	3	48	48		Autumn 2
	★ Academic German	College of Arts and Sciences	b1020040	Academic German I	test	3	48	48		Autumn 1
		College of Arts and Sciences	b1020041	Academic German II	test	3	48	48		Spring 1
		College of Arts and Sciences	b1020042	Academic German III	test	4	64	64		Autumn 2
	★ Academic Japanese	College of Arts and Sciences	b1020077	Academic Japanese I	test	3	48	48		Autumn 1
		College of Arts and Sciences	b1020078	Academic Japanese II	test	3	48	48		Spring 1
		College of Arts and Sciences	b1020079	Academic Japanese III	test	4	64	64		Autumn 2
				Subtotal (Public Fundamental Course)		**57.5**	**1056**	**976**	**80**	
General Education	selective	Art Education Center	b0-----	Aesthetic Education	non-test	2	32	32		Autumn, Spring
	selective	Each College	b0-----	Social Sciences and Humanistic Qualities	non-test	4	64	64		Autumn, Spring
				Natural Sciences and Technology Innovation	non-test	4	64	64		Autumn, Spring
			Subtotal	**(General Education)**		**10**	**160**	**160**		

IX. Teaching schedule (2)

Category	Type	Provided by	Course Code	Course Name	Assessment	Credit	Course Hours	Theory Learning	Practical Training	Recommended semester
Engineering Fundamental Course	required	College of Arts and Sciences	b2022147	Discrete Mathematics	test	4	64	64		Spring 1
				Subtotal (Engineering Fundamental Course)		**4**	**64**	**64**		
Professional Fundamental Course	required	School of Computer and Information Engineering	b2012238	Introduction to the Program of Data Science and Big Data Technology	non-test	2	32	32	0	Autumn 1
	required	School of Computer and Information Engineering	b2012018	Fundamentals of Programming	test	4	64	48	16	Autumn 1
	required	School of Computer and Information Engineering	b2012231	Data Structures and Algorithms	test	4	64	56	8	Spring 1
	required	School of Computer and Information Engineering	b2012007	Java Programming	test	3	48	32	16	Autumn 2
	required	School of Computer and Information Engineering	b2012106	Algorithm design and analysis	test	3	48	36	12	Autumn 2
	required	College of Arts and Sciences	b2012264	Fundamentals of Statistics	test	3	48	40	8	Autumn 2
	required	School of Computer and Information Engineering	b2012258	Introduction to Database Systems	test	3	48	39	9	Autumn 2
	required	College of Arts and Sciences	b2012159	Operations Research	test	2	32	32	0	Spring 2
	required	School of Computer and Information Engineering	b2012239	Operating systems	test	3	48	39	9	Spring 2
	required	School of Computer and Information Engineering	b2012170	Object Oriented Analysis and Design	test	3	48	30	18	Spring 2
				Subtotal (Professional Fundamental Course)		**30**	**480**	**384**	**96**	
Professional Course	required	School of Computer and Information Engineering	b2012045	Computer networks	test	3	48	39	9	Autumn 2
	required	School of Computer and Information Engineering	b2012268	Linux operating system applications	test	3	48	32	16	Spring 2
	required	School of Computer and Information Engineering	b2012352	Data processing programming	test	3	48	32	16	Autumn 3
	required	School of Computer and Information Engineering	b2012267	Machine Learning	test	3	48	32	16	Autumn 3
	required	School of Computer and Information Engineering	b2012085	Data visualisation	non-test	2	32	24	8	Autumn 3
	required	School of Computer and Information Engineering	b2012313	Cloud Computing and Data Centers	test	2	32	24	8	Autumn 3
	required	School of Computer and Information Engineering	b2012110	Application and development of statistical software	non-test	2	32	24	8	Autumn 3
	required	School of Computer and Information Engineering	b2012270	Distributed Computing	test	3	48	32	16	Spring 3
	required	School of Computer and Information Engineering	b2012353	Distributed Databases	test	3	48	32	16	Spring 3
	required	School of Computer and Information Engineering	b2012354	Neural Networks and Deep Learning	test	3	48	32	16	Spring 3
				Subtotal(Required Professional Course)		**27**	**432**	**303**	**129**	
	Select different courses in different modules for 7 credits	Modules A	b2012346	Foundations of Brain and Cognitive Science	non-test	2	32	32	0	Autumn 3
			b2012273	Text mining and parsing	test	2	32	24	8	Spring 3
			b2012355	Big Data Analytics and In-Memory Computing	test	3	48	32	16	Autumn 4
		Modules B	b2012356	Website design and development	test	3	48	24	24	Spring 3
			b2012135	Mobile internet technology	non-test	2	32	24	8	Autumn 4
			b2012303	Intelligent interaction technology	non-test	2	32	20	12	Autumn 4
				Subtotal (Selective Professional Course)		**7**	**112**	**88**	**24**	
				Subtotal (Professional Course)		**34**	**544**	**391**	**153**	

IX. Teaching schedule (3)

Category	Type	Provided by	Course Code	Course Name	Assessment	Credit	Course Hours	Theory Learning	Practical Training	Recommended semester
Professional Practice	required	School of Computer and Information Engineering	b4012005	Programming and Practice	non-test	2	48	0	48	Summer 1
	required	School of Computer and Information Engineering	b4012050	Data Structures and Algorithms Course Placement	non-test	2	48	0	48	Summer 1
	required	School of Computer and Information Engineering	b4012054	Database Systems Course Placement	non-test	2	48	0	48	Summer 2
	required	Engineering Training	b4090002	Basic Engineering Training B	non-test	2	48	0	48	Summer 2
	required	School of Computer and Information Engineering	b4012217	Data Visualisation Course Design	non-test	2	48	0	48	Summer 3
	required	School of Computer and Information Engineering	b4012209	Integrated design for intelligent analysis of large volumes of data	non-test	4	96	0	96	Summer 3
	required	School of Computer and Information Engineering	b4012186	Labour Education B	non-test	0.5	16	0	16	Spring 3
	required	School of Computer and Information Engineering	b4012210	Integrated design for big data open source software development	non-test	3	72	0	72	Autumn 4
	required	School of Computer and Information Engineering	b4000019	the Program of Data Science and Big Data Technology Innovation and Entrepreneurship	non-test	2	48	0	48	Autumn 4
	required	School of Computer and Information Engineering	b4012211	Data Science and Big Data Technology Graduation Internship and Graduation Design (Thesis)	non-test	6	288	0	288	Spring 4
Subtotal (Professional Practice)						**25.5**	**760**		**760**	
Extracurricular Class	required	Others	b5110001	Extracurricular Class	non-test	**1**	-	-	-	Autumn, Spring, Summer
Total						**162**	**3064**	**1975**	**1089**	

★ Description of Selective Professional Course:

Selective Professional Courses are divided into modules according to different competency requirements, and students must take one of the modules and achieve the required credits for that module.

Module A: Intelligent Analysis and Processing of Big Data

Focuses on in-depth learning of Hadoop/Spark development, distributed computing, distributed database, machine learning, neural network and deep learning and other big data analysis and processing related technologies, cultivating comprehensive technical personnel with distributed big data processing, data mining and other capabilities, and able to carry out related big data storage, analysis, big data information mining.

Module B: Mobile Internet Data Analysis and Processing

Focuses on in-depth study of industrial data collection and pre-processing, mobile internet technology, intelligent interaction and other related technologies, cultivating comprehensive technical personnel with the ability to process and analyse industrial data, etc., and capable of carrying out big data analysis and processing in specific fields.

X. Prerequisite for Course Study

No.	Course Name	Prerequisite Course
1	Discrete Mathematics	Linear Algebra
2	Operations Research	Advanced Mathematics, Linear Algebra
3	Programming and Practice	Fundamentals of Programming
4	Data Structures and Algorithms	Fundamentals of Programming
5	Data Structures Course Placement	Data Structures and Algorithms
6	Introduction to Database Systems	Discrete Mathematics
7	Fundamentals of Statistics	Probability Theory and Mathematical Statistics
8	Algorithm design and analysis	Data Structures and Algorithms
9	Operating systems	Fundamentals of Programming, Data Structures and Algorithms
10	Object Oriented Analysis and Design	Fundamentals of Programming
11	Distributed Databases	Introduction to Database Systems
12	Distributed Computing	Fundamentals of Programming
13	Machine Learning	Fundamentals of Statistics, Linear Algebra
14	Practice for Database systems	Introduction to Database Systems
15	Text mining and parsing	Linear Algebra, Fundamentals of Programming
16	Cloud Computing and Data Centers	Introduction to Database Systems, Fundamentals of Programming
17	Statistical software application and development	Fundamentals of Statistics
18	Machine Learning Technology Course Placement	Machine Learning
19	Neural Networks and Deep Learning	Machine Learning
20	Practice for Data visualisation	Data visualisation
21	Data processing programming	Fundamentals of Programming
22	Linux operating systems	Fundamentals of Programming, Operating Systems
23	Website development and design	Fundamentals of Programming, Introduction to Database Systems
24	Big Data Analytics and In-Memory Computing	Fundamentals of Programming, Distributed Computing
25	Mobile internet technology	Computer networks
26	Network and Data Security	Mobile internet technology
27	Comprehensive Practice for Open Source Software Development for Big Data	Fundamentals of Programming, Distributed Computing, Cloud Computing and Data Centers, Linux Operating Systems
28	Comprehensive practice for intelligent analysis of massive data	Distributed Computing, Fundamentals of Programming, Machine Learning
29	Mobile internet technology	Computer networks
30	Foundations of Brain and Cognitive Science	Machine Learning, Neural Networks and Deep Learning

XI. Credit of Extracurricular Class

Through taking extracurricular classes, students are encouraged to take part in academic lectures, social practice activities, campus cultural and sports activities, innovative and entrepreneurial activities, voluntary activities, etc. to improve their social adaptability and enhance the competitiveness in the job market. Details are specified in Students' Manual.