

# Control Science and Engineering

## 控制科学与工程

(081100)

### 1. Overview of the Program

The first-level discipline “Control Science and Engineering” has a Post-doctoral research station. The discipline was selected to enter the list of “Double-First Class” discipline construction plan by the Ministry of Education in 2017. It was evaluated as a Class A discipline in the fourth round of discipline assessment by the Ministry of Education. The second-level disciplines under the first-level discipline are “Detection Technology and Automatic Equipment”, “Pattern Recognition and Intelligent Systems”, “Navigation, Guidance and Control”, “Control Theory and Control Engineering”, “Intelligent Information Processing and Control” and “Electrical Engineering and Control”. “Control Theory and Control Engineering” was honored as a National Key Discipline; “Navigation, Guidance and Control” was honored as a National Key Cultivating Discipline; “Pattern Recognition and Intelligent Systems” was honored as a State Commission of Science and Technology for National Defense Industry Key Discipline; “Control Science and Engineering” was honored as a Key First-Level Discipline of Beijing.

Control Science and Engineering studies on moving objects, industrial equipment and human-computer-object fusion systems. It aims to enhance the ability of human beings to understand and change the world. This discipline uses the knowledge of information technology, computer technology, test technology, artificial intelligence and basic knowledge of research objects to do research on system modeling, dynamic analysis, prediction, control and decision making. The discipline focuses on the combination of theoretical research and engineering applications, interdisciplinary research and military-civilian integration, and has played a major role in the development of our national economy and the defense of national security.

The main research directions of this discipline are:

(1) Test Technology and Automation Equipment: Advanced technology for sensors and testing; Transmission and control of electricity, liquid and gas; New-type actuators and automation equipment; Intelligent instruments and controllers; Integration and networking of measurement and control systems;

Fault diagnosis and tolerance of measurement and control systems.

(2) Pattern Recognition and Intelligent Systems: Intelligent control and intelligent systems; Computational intelligence and optimal decision making; Pattern recognition and machine learning; Image comprehension and computer vision; Multi-Agent synergetic control; Command control and decision systems; Intelligent control of unmanned systems; Distributed simulation of complex systems.

(3) Navigation, Guidance and Control: Inertial navigation for positioning and orientation; Integral navigation and intelligent navigation; Inertial devices and system testing; Bionic navigation; Geophysical field information matching assisted navigation; Guidance, control and simulation of aircraft; New-type inertial devices; Multi-source navigation information sharing and control.

(4) Control Theory and Control Engineering: Modeling, control, optimization, decision and simulation of complex systems; Robust control and self-adaptive control; Nonlinear filtering and control; Integrated control and optimization of engineering systems; Design and analysis of motion control systems; Advanced control theory and methodologies; Biomedical information processing; Autonomous control of unmanned systems.

(5) Intelligent Information Processing and Control: Systems engineering theory and its applications; Modeling, optimization and synthesis of systems; Analysis and control of complex systems; Network information processing and control; Neural network and deep learning; Fault diagnosis and reliability analysis; cloud control systems and its application.

(6) Electrical Engineering and Control: Power electronic conversion and control; Motor control and new-type motor design; High precision servo control; Renewable energy technology and its applications; New energy power systems and control; Control and management of smart grid; Theory and new technology of electrical engineering.

## **2. Training Target**

The target is to train high-level innovative talents who have a good knowledge of international common sense, with the ability of spreading Chinese and foreign cultures occupied, so that to bring international graduate students into full play as a cultural bridge.

## **3. Length of Schooling**

The basic length of schooling for master students is 2 years. In principle, students should complete the courses in the first academic year. Thesis work time should not be less than one year. The maximum length of study for master students is extended by 0.5 years on the basis of 2 years. The basic length of schooling for Ph.D. students is 4 years. In principle, students should complete the courses in the first

academic year. Thesis work time should not be less than three years. The maximum length of study for Ph.D. students is extended by 2 years on the basis of 4 years.

#### 4. Curriculum and Credit Requirements

Course Classification	Course Code	Course Name	Course Hours	Credits	Semester	Requirements	Master /Ph.D.	Credits Requirement	
Public Course	3700001	Chinese Language 汉语	96	3+3	1+2	Compulsory	Master /Ph.D.	Master=6 Ph.D.=6	
	3700002	Outline of China 中国概况	32	2	1/2	Compulsory	Master /Ph.D.	Master=2 Ph.D.=2	
Optional course	Major Optional course	0601001	Linear Algebra in Automatic Control 自动控制中的线性代数	48	3	1	Compulsory	Master	Master $\geq 10$ Ph.D. $\geq 6$
		0601002	Linear Systems Theory 线性系统理论	48	3	1	Compulsory	Master	
		0601003	Stochastic Processes Theory and Applications 随机过程理论及应用	48	3	1	Optional	Master /Ph.D.	
		0601004	Optimal and Robust Control 最优与鲁棒控制	48	3	2	Optional	Master /Ph.D.	
		0601005	Computer and Distributed Control Systems	32	2	2	Optional	Master /Ph.D.	

**Beijing Institute of Technology Graduate Program 2018**

			计算机与分布式控制系统					
		0601006	Multi-source Information Filtering and Fusion 多源信息滤波与融合	32	2	2	Optional	Master /Ph.D.
		0601007	Systems Engineering Principles and Applications 系统工程原理与应用	32	2	1	Optional	Master /Ph.D.
		0601008	Modern Power Electronics 现代电力电子学	32	2	2	Optional	Master /Ph.D.
		0600002	Progress in Control Science 控制科学进展	48	3	1	Compulsory	Ph.D.
Total Credits		Master $\geq 18$ credits			Ph.D. $\geq 14$ credits			

**Notes:**

**1. Public Courses**

(1) Chinese Language: Set by International Students Center of BIT. All international students must take this compulsory course.

(2) Outline of China: Set by International Students Center of BIT. All international students must take this compulsory course.

**2. Major Basic Courses**

Different Programs can set their own Major Basic Courses.

**3. Optional Course**

(1) Major Core Courses

Different Programs can set their own Major Core Courses.

(2) Major Optional courses

Master international students must take two optional courses of their own Program. Under the guidance of the supervisor, Master international students can take undergraduate courses if needed. Ph.D. international students can take undergraduate courses if needed.

#### **4. Courses in Chinese**

Foreign students can take courses in Chinese from the program for the Academic Graduate Students.

#### **5. Practice Part**

##### **1. Academic Activity (1 credit)**

International Graduate Students need to participate in academic activities, academic lectures and academic conferences of their own fields. Giving oral speeches on academic conferences, whether on or off campus, are highly recommended.

##### **2. Innovative Practice (1 credit)**

International Graduate Students should take scientific research training and social practices during their training period, which should be carried-out and evaluated by supervisors.

#### **6. The Dissertation Related Work**

##### **1. Literature Review & Opening Report**

Under the guidance of the supervisor, International Graduate Students should pick a research direction as well as reading certain amount reference books, both Chinese or foreign languages, at the same time.

Master students should write a literature review, no less than 4000 words, based on the reading of over 30 papers, both Chinese or foreign languages, of their own research field.

Ph.D. students should write a literature review, no less than 5000 words, based on the reading of over 50 papers, both Chinese or foreign languages, of their own research field.

On the basis of the Literature Review, the Opening Report should mainly introduce following factors: research target, research meaning, methods of research, technical route, implementary plan, arrangements and expected results.

##### **2. Mid-Term Evaluation**

Schools organize Mid-Term Evaluation for International Students, which includes the evaluations of course study, literature review, opening report and the research progress of publishing papers and writing of Degree thesis.

3. Thesis Writing and Thesis Pre-Defense (for Ph.D. students)

International Graduate Students should complete a Degree thesis under the guidance of supervisors. Ph.D. students can take the Thesis Pre-Defense after finishing a supervisor-approved first draft.

4. Thesis Defense

After thesis approved and the Sub-Committee of Degree Assessment authorized, International Graduate Students can take the Thesis-Defense.

5. Degree Conferment

International students should acquire certain academic results as regulated when applying for a Master or Ph.D. Degree. Each program should clarify the categories of Master Degree and Ph.D. Degree.

**Time nodes of relevant procedure**

<b>The Dissertation Related Work</b>	<b>Master</b>	<b>Ph.D.</b>
Literature Review& Opening Report	Before week 1 of the 3 <sup>rd</sup> semester	Before week 1 of the 5 <sup>th</sup> semester
Mid-Term Evaluation	week 1-2 of the 4 <sup>rd</sup> semester	Before week 1 of the 7 <sup>th</sup> semester
Thesis Pre-Defense	---	Before Blind review
Thesis Defense	At least 9 months after the Opening Report	At least 18 months after the Opening Report
Degree Application	The application should be raised in a certain time after the Thesis Defense	

**7. Course Syllabus**

Course Code, Course Name, Class Hour, Credits, Course Description and Course Target, Teaching Method, Evaluation and Exams, Suitable Specialty, Prerequisites, Course Contents, Reference.