Appendix B - Syllabus – Engineering Applications

Competence field	Engineering Applications
Module designation	Introduction to Urban Railway Transit
Module level, if applicable	
Code, if applicable	109101
Subtitle, if applicable	
Semester(s) in which the module is taught	2nd semester
Person responsible for the module	Associate Professor: YAO Huiming
Lecturer	Associate Professor: YAO Huiming Lecturer: ZHU Wenliang Lecturer: WEN Jing Lecturer: CHONG Lei Associate Professor: ZHU Haiyan Lecturer: SHI Rong
Language	Chinese
Relation to curriculum	This course is a compulsory foundation course for Operation Management, Traffic Engineering, Communication Signal Engineering, and Vehicle Engineering (Rail Transit Vehicle). The course mainly introduces fundamental concepts of rail transit development history and its types and forms, network planning, railway line engineering, and rail structure of urban rail transit, as well as rail transit station architecture, vehicles, power supply system, communication system, signal system, and operation management of urban rail transit, etc. From this overview course, students will understand the development and technological state of the art of rail transit which also lays a professional foundation for future studies.

Type of teaching, contact hours	Target students: freshmen of Vehicle Engineering (Rail Transit Vehicle) Type of teaching: theoretical teaching Contact hours: 32 hours Of which Theoretical teaching: 32 hours Experiment/practice teaching: 0 hour Size of class: up to 60 students for theoretical teaching
Workload	Workload = 60 hours Contact hours = 32 hours Self-study hours = 28 hours
Credit points	2.0
Requirements according to the examination regulations	Only students with class attendance rate over 2/3 and assignment completion rate over 2/3 are allowed to take the exam.
Recommended prerequisites	N/A
Module objectives/intended learning outcomes	**Learning outcomes:** The task of this course is to provide students with basis theoretical knowledge of rai transit engineering; cultivate their professional understanding of urban rail transit systems; present latest development and trends of rail transit engineering, and to develop an interest in their program. Specific objectives include: ● **Knowledge:** (1) Basic concepts and knowledge of urban rail transit system, development history and trend of urban rail transit; (2) Basic knowledge and key characteristics of the planning, design, construction, operation and maintenance of civil infrastructure of urban rail transit; (2) Composition and function of the mechanical structure of urban rail transit vehicles; composition and working principle of electric traction, braking and control systems; (4) Main structure types and power supply principle of overhead lines;

	(5) Knowledge of urban rail transit communication system, signal system, and integrated supervisory control system; (6) Basic knowledge of the operation system, station management, train operation management, passenger transportation management, and safety management of urban rail transit; ● **Skills:** (1) Ability to describe the characteristics of each system in rail transit. (1) Ability to read professional literature in rail transit at beginner's level. ● **Competence:** Adopt a systematic way of thinking, understand and analyze the composition and relationship of urban rail transit systems, understand the history, current status and trends of urban rail transit development, cultivate social development consciousness in terms of economy, environment, law, safety, and engineering ethics, and be able to understand the impact of urban rail transit on the development of the society and the world.
Contents	**Part A. Theoretical Teaching** (32 contact hours; 28 self-study hours) **Lecture 1 Introduction (Chapters 1 & 2)** (2 contact hours; 2 self-study hours) Overall layout of the content, lecturer team and contact hour arrangement History of transportation development, history of rail transit, main types and forms of rail transit*. **Lecture 2 Network Planning, Route Design And Construction of Urban Rail Transit (Chapter 3, 5 and 4)** (3 contact hours; 2 self-study hours) Content and technical route of network planning, urban rail transit passenger flow forecast** Study on network scale, network structure types and scheme studies, network scheme evaluation*

	Route selection, route layout, route vertical section, envelope** Overview of urban rail transit construction methods, urban rail transit station construction, cut-and-cover construction, urban rail transit running tunnel construction **Lecture 3 Urban Rail Transit Rail Structure** (3 contact hours; 2 self-study hours) Overview Steel rails and coupling parts, sleepers, rail fasteners, track ballast bed, non-ballasted track, turnouts** Bumper post, continuous welded rail* **Lecture 4 Urban Rail Transit Station Architecture and Rail Repair** (6 self-study hours) Characteristics of urban rail transit stations, classification of rail transit stations** Architectural plan composition of urban rail transit stations Public transit hub development, urban rail transit station culture Track maintenance mode in urban rail transit, track inspection in urban rail transit* Urban rail transit rail flaw detection** Repairs, overhauls and medium maintenance for urban rail transit, on-track reshaping of urban rail transit tracks **Lectures 5-8 Vehicle Engineering (Rail Transit Vehicle)** (8 contact hours; 6 self-study hours) Overview knowledge of urban rail transit vehicle structure characteristics, development history, basic types and marshaling identification. Basic structure, characteristics and functions of mechanical components of urban rail transit vehicles, including car body, door, bogy, coupling gear, brake and AC and ventilation device.** Basic composition, working principle and basic electric parameters of urban rail transit vehicle's electric traction system, auxiliary

	power supply system, and train control system;** Basic composition and requirements of electric power supply system of urban rail transit vehicles, composition of auxiliary power supply facilities for operation services, main structures and power supply methods of overhead lines.* **Lecture 9 Urban Rail Transit Communication System** (2 contact hours; 2 self-study hours) Communication transmission subsystem, wireless communication subsystem** Official telephone subsystem, image surveillance subsystem, broadcasting subsystem, clock subsystem, power supply subsystem, passenger guidance and information service system. **Lectures 10 & 11 Urban Rail Transit Signal System** (4 contact hours; 2 self-study hours) Signal introduction, signal infrastructure Interlocking system, block system** Automatic Train Control System, CBTC system**. **Lecture 12 Urban Rail Transit Integrated Supervisory Control** (2 contact hours; 2 self-study hours) Structure, function, software structure and operation management of integrated supervisory control system. **Lectures 13, 14 & 15 Urban Rail Transit Operation Management** (8 contact hours; 4 self-study hours) Operation management system, management mode and development trend of urban rail transit. Passenger flow and spatial and temporal distribution characteristics in urban rail transit;** Vehicle scheduling in transportation planning; form of train diagram, key positions and division of work, general workflow.** Passenger traffic equipment and organization

	of urban rail transit Urban rail transit safety management objectives and principles. **Part B. Experiment teaching** (0 contact hours; 0 self-study hours)
Study and examination requirements and forms of examination	Final score includes: attendance (10%), usual performance (30%, in which after-class exercise accounts for 40% and major assignments 60%); final exam (60%)
Media employed	Multimedia computers, projectors, laser pointers, blackboards, chalks
Reading list	1. Required books [1]TAN Fuxing, QIU Weihua, FANG Yu. *Overview of Urban Rail Transit System.* Beijing: China Water & Power Press. 2013 2. Reference books [1] ZHANG Zhenmiao. *Urban Rail Transit Vehicles.* Beijing: China Railway Publishing House. 2007 [2] SUN Zhang. *Introduction to Urban Rail Transit.* China Railway Publishing House. 2000. [3] HE Zonghua et al. *Urban Rail Transit Operation Organization.* Beijing: China Architecture and Building Press. 2003 [4] YE Xiafei. *Urban Rail Transit Planning and Design.* China Railway Publishing House. 1999. [5] MAO Baohua. *Urban Rail Transit.* Beijing: Science Press.2001 [6] XU Jinxiang. *Traffic Signal for Urban Railway Transportation.* Beijing: China Railway Publishing House. Sept 2010 [7] GAO Jixiang. *A Beginner's Guide to Traffic Signal Operation for Railway Transportation.* Beijing: China Railway Publishing House. 1998

Competence field	Engineering Applications
Module designation	Construction and Principle of Vehicle Engineering (Rail Transit Vehicle)
Module level, if applicable	
Code, if applicable	109109
Subtitle, if applicable	
Semester(s) in which the module is taught	5th semester
Person responsible for the module	Associate Professor WEN Yongpeng
Lecturer	Associate Professor WEN Yongpeng Lecturer WEN Jing Lecturer HE Yu
Language	Chinese
Relation to curriculum	This is a foundation course designed for students majoring in Vehicle Engineering (Rail Transit Vehicle). This course aims to provide students with a thorough grounding in the basic structure of bogies, vehicle connection devices, car bodies, and doors for urban railway vehicles, as well as an appreciation of the principle of braking system. The basic algorithms to determine forces and force strength acting on vehicles will also be fully developed and the principles of vehicle dynamics will be described. The methods of calculating related factors for urban railway vehicle operation, the principle of noise and noise reduction, and an overview of innovative urban railway vehicles will also be given. After successfully completing this course, students will be able to acquire comprehensive knowledge in the basic structures, basic principles and methods of urban railway vehicles, and apply the concepts and techniques learned in this course to solve related engineering design issues in real

	engineering contexts, aiming to prepare students to work and succeed in their railway vehicle work of future.
Type of teaching, contact hours	Target students: juniors of Vehicle Engineering (Rail Transit Vehicle) Type of teaching: theoretical teaching Contact hours: 32 hours Of which Theoretical teaching: 30 hours Experiment/practice teaching: 2 hours Size of class: up to 60 students for theoretical teaching
Workload	Total workload = 60 hours Contact hours = 32 hours Self-study hours = 28 hours
Credit points	2.0
Requirements according to the examination regulations	Only students with class attendance rate over 2/3 and assignment completion rate over 2/3 are allowed to take the exam.
Recommended prerequisites	Mechanical Principle, Fundamentals of Drawing, Engineering Mechanics, Overview of Urban Rail Transit System
Module objectives/intended learning outcomes	**Learning outcomes:** This course aims to provide students with a sound basis of knowledge in urban railway vehicles and their applications, and an appreciation of the basic structures, basic principles and methods of urban railway vehicles. After successfully completing this course, students will be able to apply the

	concepts and techniques learned in this course to solve related engineering design issues in real engineering contexts. Specific objectives include: ● **Knowledge:** 1. The basic structures of urban railway vehicles, including bogies, vehicle connection devices, car bodies and doors, and braking devices; 2. Vehicle design methods, vehicle force analysis and strength calculation; 3. Basic vehicle dynamics models and calculation methods for train operation. ● **Skills:** 1. Make use of mechanical principles, mechanical design principles and mechanics principles to analyze the correlation between the structures of urban railway vehicles and their function. 2. Demonstrate skills in performing force analysis and strength calculation of vehicle structure; 3. Demonstrate skills in establishing vehicle dynamics models and performing basic dynamic theoretical analysis. ● **Competence:** After successfully completing this course, students will be able to apply the knowledge and skills they have learned in real urban railway vehicle context, and develop basic skills to design key parts of urban railway vehicles. This course will also develop students' critical thinking skills for vehicle design, and enable them to track the development trend of new technologies for urban railway vehicles. This course will also help students to have a better understanding of the impact of vehicle engineering on the whole world and society, and expand their knowledge.

Contents	Part A Theoretical teaching (30 contact hours; 26 self-study hours) Part 1. Introduction to Urban Rail Transit and Basic Knowledge about Vehicles (4 contact hours; 2 self-study hours) Vehicle technical parameters.* Features of urban railway vehicles.* Inevitability of urban rail transit development.** Significance of vehicle technical parameters.* Part 2. Basic Structure of Urban Railway Vehicles (16 contact hours; 6 self-study hours) Bogie structure and principle, vehicle connection device, vehicle body, and door brake system. Features of basic structure of urban railway vehicles*. Basic structure and design of urban railway vehicles. Part 3. Principles of Vehicle Structure Design (2 contact hours; 4 self-study hours) General method for calculating load on car body and the bogie and vehicle strength.* Force applied on the vehicle and the effect of force.* Theories of vehicle strength calculation.** Part 4. Principles of Vehicle Vibration (2 contact hours; 4 self-study hours) Basic forms of vehicle vibration and evaluation criteria of vehicle operation safety. Understanding of the six degrees of freedom of vehicle vibration.* Features of snake movement. Basis for establishing evaluation criteria of vehicle operation safety.** Part 5. Principles of Vehicle Operation (2 contact hours; 4 self-study hours) Force applied on a moving vehicle.* Basic theories of traction calculation.*

	Vehicle operation process. Basic vehicle function. Basic idea of traction calculation.* Modeling a vehicle operation process.* Part 6. Vehicle Noise and Noise Reduction (2 contact hours; 4 self-study hours) Classification of noise. Noise evaluation criteria. Noise reduction methods. Classification of noise.* Noise reduction methods.** Part 7. New Urban Railway Vehicles (2 contact hours; 2 self-study hours) Development status and technical level of urban railway vehicles in China General trend and new technology of urban railway vehicles in other countries. Classification of new urban railway vehicles.* General trend and new technology of urban railway vehicles at home and abroad.** **Part B Experiment / practice teaching** (2 experiment hours; 2 self-study hours) 1. Knowledge of bogie structure (0.5 experiment hours; 0.5 self-study hours) 2. Knowledge of pantograph structure (0.5 experiment hours; 0.5 self-study hours) 3. Knowledge of door structure (0.5 experiment hours; 0.5 self-study hours) 4. Knowledge of coupler structure (0.5 experiment hours; 0.5 self-study hours)
Study and examination requirements and forms of examination	Examinations will be used to evaluate student learning in this course. The total score consists of five components as follows: 1. Attendance: 5%. 2. After-class assignment: 5%. 3. Big project: 10%. 4. In-class experiment: 10% 5. Final exam: 70%. This will be a closed-book exam. The closed book part is designed to assess the students' understanding

	of basic concepts, structural features, principles and other knowledge. Types of questions in this exam may include multiple-choice, short answer, fill-in-the-blank, etc.
Media employed	Multimedia computers, projectors, laser pointers, blackboards, chalks
Reading list	1. Required books [1] FANG Yu, SHI Wei, SHI Xuan, et al.. *Introduction to Urban Railway Vehicle*. Beijing: China Railway Publishing House. 2012. 2. Reference books [1]YAN Junmao. *Vehicle Engineering.* Beijing: China Railway Publishing House, 2007. [2] WANG Boming. *Urban Rail Transit Vehicle Engineering.* Chengdu: Southwest Jiaotong University Press, 2007. [3] WANG Xueming. *Locomotive Bogie Technology.* Chengdu: Southwest Jiaotong University Press, 2009. [4] ZENG Qingzhong, DENG Jingshan. *Vehicle Air Conditioning and Refrigeration Equipment.* Chengdu: Southwest Jiaotong University Press, 2008. [5] Edited by ZHANG Zhenmiao. *Urban Rail Transit Vehicles.* Beijing: China Railway Publishing House, 2007.

Competence field	Engineering Applications
Module designation	Electrical Traction and Control of Urban Railway Vehicle
Module level, if applicable	
Code, if applicable	109115
Subtitle, if applicable	
Semester(s) in which the module is taught	5th semester
Person responsible for the module	Associate professor: SHI Wei
Lecturer	Associate professor: SHI Wei Lecturer: YUAN Tianchen Lecturer: SHU Yanjun
Language	Chinese
Relation to curriculum	This course is one of the core courses for the students of Vehicle Engineering (Rail Transit Vehicle) of the School of Urban Rail Transportation. The content of the course includes the basic composition, speed regulation principle and basic control method of DC and AC electric traction in urban rail transit, principle and composition of vehicle's main circuit and control circuit, and the forms and control methods of traction for new types of urban rail transit. The objectives and tasks of the course are to enable the students to learn the basic composition and principles of the DC and AC drive speed regulation and control system of urban rail transit vehicles, and to understand the principles and composition of the vehicle's main circuit and control circuit, several typical drive and control system examples and the forms and control methods of traction for new types of urban rail transit.

Type of teaching, contact hours	Target students: students of Vehicle Engineering (Rail Transit Vehicle) Type of teaching: theoretical teaching Contact hours: 32 hours Of which Theoretical teaching: 32 hours Experiment / practice teaching: 0 hour Size of class: up to 70 students for theoretical teaching
Workload	Workload = 60 hours Contact hours = 32 hours Self-study hours = 28 hours
Credit points	2.0
Requirements according to the examination regulations	Only students with class attendance rate over 2/3, assignment completion rate over 2/3, and performing required experiments are allowed to take the exam.
Recommended prerequisites	
Module objectives/intended learning outcomes	Module objectives: This course aims to provide students with a thorough knowledge grounding in solving complicated traction engineering problems in the field of vehicle engineering, as well as integrated thinking, engineering reasoning, problem solving, and managerial/organizational skills required for vehicle traction engineering problems. Specific objectives include: **Knowledge:** 1. Composition, function and classification of the transmission of urban rail transit vehicles; 2. Basic composition and principle of DC and AC drive speed regulation and control system for urban rail transit; 3. Principle and composition of vehicle's main circuit and control circuit, several typical examples of drive and control systems, and the forms and control methods of traction for new types of urban rail transit.

	Skills: 1. Ability of simplification, modeling and calculation of urban rail transit vehicle traction systems; 2. Ability to analyze the characteristics of the speed regulation system of urban rail vehicles; 3. Ability to analyze the traction and speed regulation systems of new types of urban rail transit. **Competence:** acquire comprehensive knowledge of traction and control. Be able to reasonably analyze and evaluate actual problems in vehicle engineering traction and provide valuable solutions using engineering background knowledge.
Contents	**Part A. Theory teaching** (32 contact hours; 28 self-study hours) **Chapter 1 Overview of Urban Rail Vehicle Power Transmission and Control** (2 contact hours; 2 self-study hours) Characteristics of rail vehicle electric traction system Function and composition of urban rail vehicle electric traction system** Classification of urban rail vehicle electric traction system* Mechanical transmission process of urban rail transit electric traction system* Development of urban rail transit electric traction system **Chapter 2 Fundamentals of Urban Rail Transit Vehicle Traction** (4 contact hours; 2 self-study hours) Wheel rail contact theory Adhesion control* Characteristics of electric traction system in urban rail transit vehicles Train motion equation Relationship between train traction characteristics and motor characteristics **Chapter 3 DC Electric Traction and Control** (8 contact hours; 3 self-study hours) Mechanical characteristics of DC motor* Speed regulation characteristics of DC motor* Chopped wave speed regulating of DC motor**

	Feedback control of DC motor** Analysis of DC electric traction examples in urban rail transit **Chapter 4 Steady State Control of AC Traction Motor** (6 contact hours; 8 self-study hours) Operating principle of AC motor Steady state mathematical model of three-phase asynchronous motor* Variable voltage and variable frequency speed regulation of three-phase asynchronous motor* Power electronics VVVF inverter Slip frequency control** **Chapter 5 Transient Control of AC Traction Motor** (8 contact hours; 8 self-study hours) Transient mathematical model for AC motor* Vector control of AC motor** Direct torque control of AC motor** Analysis of AC electric traction examples in urban rail transit **Chapter 6 Train Traction Control System** (2 contact hours; 3 self-study hours) Train traction microcomputer control system Train traction control system Interface between train traction control system and signal system Interlocking relationship between train traction control system and other controls of the vehicle* Analysis of traction control system examples in urban rail transit **Chapter 7 New Types of Electric Traction System** (2 contact hours; 2 self-study hours) Characteristics of linear motor driven traction system* Basic speed regulation methods for linear motor driven traction system Characteristics of permanent magnet motor driven traction system* Basic speed regulation methods for permanent magnet motor driver traction system **Part B. Experiment teaching** (0 contact hours; 0 self-study hours)

Study and examination requirements and forms of examination	1. Basic requirements for class (no late arrivals, no early departures, and no unauthorized absences) 10%. 2. Assignments (including homework 30% and big project 70%) 30%. 3. Final exam 60%.
Media employed	Multimedia computers, projectors, laser pointers, blackboards, chalks
Reading list	Reading list Required books: SHI Wei. *Electrical Traction and Control of Urban Rail Vehicle.* Shanghai: Lecture notes of Shanghai University of Engineering Science, 2019 Reference books: [1] WANG Jianpu. *Electric Traction and Control of Urban Rail Transit (2nd Edition).* Chengdu: Southwest Jiaotong University Press, 2018 [2] FENG Xiaoyun. *Electric Traction AC Drives and Control System.* Beijing: Higher Education Press, 2009 [3] SONG Wensheng, FENG Xiaoyun. *Control and Modulation Technologies of Electric Traction AC Drives.* Beijing: Science Press, 2014 [4] Bimal K. Bose. Modern Power Electronics and AC Drivers. Beijing: Machinery Industry Press, 2004 [5] Haitham Abu-Rub. High Performance Control of AC Drives with MATLAB/Simulink Models Beijing: Machinery Industry Press, 2018

Competence field	Engineering Applications
Module designation	Braking Technique of Urban Railway Vehicle
Module level, if applicable	
Code, if applicable	109110
Subtitle, if applicable	
Semester(s) in which the module is taught	5th semester
Person responsible for the module	Associate Professor YAO Huiming
Lecturer	Associate Professor YAO Huiming Lecturer ZHU Wenliang Lecturer WU Aizhong
Language	Chinese
Relation to curriculum	Braking Technique of Urban Railway Vehicle is a compulsory core course designed for students majoring in Vehicle Engineering (Rail Transit Vehicle). This course starts from the basic theory of railway vehicle braking, and investigates the basic concepts of railway vehicle braking, the composition and function of braking system, and the typical train braking systems at home and abroad. Topics covered in this course include the basic braking theory and calculation, the history of railway vehicle braking development, the composition and function of urban railway vehicle braking system, the analog/digital electric parking brake control systems and the anti-skid braking control system technology and its development trends. This course aims to provide students with an in-depth knowledge of basic structure and braking principle of braking system for urban railway trains, with an emphasis on developing students' skills in calculating and analyzing braking system failures of urban railway vehicle.

Type of teaching, contact hours	Target students: juniors of Vehicle Engineering (Rail Transit Vehicle) Type of teaching: theoretical teaching Contact hours: 32 hours Of which Theoretical teaching: 32 hours Experiment/practice teaching: 0 hour Size of class: up to 60 students for theoretical teaching
Workload	Total workload = 60 hours Contact hours = 32 hours Self-study hours = 28 hours
Credit points	2.0
Requirements according to the examination regulations	Only students with class attendance rate over 2/3 and assignment completion rate over 2/3 are allowed to take the exam.
Recommended prerequisites	Physics (Mechanics), Physics (Electromagnetism), Overview of Urban Rail Transit System, Structure of Urban Railway Vehicle
Module objectives/intended learning outcomes	**Learning outcomes:** This course aims to provide students with a thorough grounding in the basic principles of braking systems and braking related basic theories for urban railway vehicle. Specific objectives include: ● **Knowledge:** (1) Basic theory of braking system for urban railway vehicle, basic principles of electric braking control system and air braking control system. (2) Basic structural principle and technology of basic braking devices. (3) Basic criterion theory of anti-skid system, brake calculation theory and other expertise. ● **Skills:**

	(1) Demonstrate skills in describing basic structure of braking system for urban railway vehicle and its relationship with other vehicle systems; (2) Demonstrate skills in analyzing and solving actual problems occurred in braking system failures of urban railway vehicle and maintenance tasks, as well as skills in proposing appropriate solutions; (3) Demonstrate skills in preliminarily designing repair process for vehicle braking system, auxiliary repair equipment for braking system or braking system components based on specific needs; (4) Demonstrate skills in modeling, calculating, testing and analyzing complex problems occurred in vehicle braking system failures. ● **Competence:** After successfully completing this course, students will be able to acquire comprehensive knowledge in vehicle braking, and skills in making use of engineering background knowledge to reasonably analyze and evaluate actual problems occurred in braking system failures of urban railway vehicle and maintenance tasks. Students will be able to provide valuable maintenance process solutions or preliminary design solutions for brake system components. They will also demonstrate their innovative spirit in maintenance process design or preliminary design of brake system components.
Contents	**Theoretical teaching** (32 contact hours; 28 self-study hours) **Chapter 1. Introduction to Braking Technology for Urban Railway Vehicle** (4 contact hours; 2 self-study hours) Basic braking concept; History of braking system development; Main functions and components of modern railway braking systems*. **Chapter 2. Basic Braking Theory and**

	Electric Braking System (6 contact hours; 6 self-study hours) Adhesion, traction and braking**; Concept of idling and skiding; Basic principle of electric braking for urban railway trains*; DC and AC traction drive and electric brake*; Resistance braking. **Chapter 3. Mechanical Braking System and Train Braking Control System** (14 contact hours;14 self-study hours) Air compressor, air dryer and air cylinder**; Braking control unit*; Electronically controlled braking control system*; Braking control strategy**; Adhesion control; Main types of basic braking devices; Structure and composition of unit brake**; Disc brake; Other components of gas supply system **Chapter 4. Brake Assist System and Braking Force Calculation** (4 contact hours; 4 self-study hours) Necessity of anti-skid control Development of anti-skid technology Anti-skid control mechanism and system analysis** Calculation of deceleration force Calculation of braking distance* **Chapter 5. Structure and Principle of Various Types of Electronically Controlled Brake Control Systems** (4 contact hours; 2 self-study hours) SD electronically controlled digital braking control system KBGM electronically controlled analog braking system** KBWB electronically controlled analog braking system EP2002 braking system* Braking system maintenance process and equipment

Study and examination requirements and forms of examination	Final score includes: attendance (10%), usual performance (30%, in which after-class exercise accounts for 40% and major assignments 60%); final exam (60%)
Media employed	Multimedia computers, projectors, laser pointers, blackboards, chalks
Reading list	1. Required books [1] YAO Huiming. *Urban Rail Transit Vehicle Braking System.* Beijing: China Railway Publishing House, 2018 2. Reference books [1] LI Yimin, YANG Dong. *Maintenance and Overhaul of Braking System for Urban Railway Vehicles.* Beijing: Machinery Industry Press, 2012. 2] YING Yunfei, QIN Juanlan. *Urban Rail Transit Vehicle Braking System.* Chengdu: Southwest Jiaotong University Press, 2011. [3] ZHANG Wangshi. *Vehicle Braking Device.* Beijing: China Railway Publishing House, 2004. [4] CHEN Daming. *Railway Vehicle Braking.* Beijing: China Railway Publishing House, 2004. [5] SHU Qiping. *Braking Technology for Urban Railway Vehicles*. Beijing: China Water & Power Press. 2013

Competence field	Engineering Applications
Module designation	Network Control Technology of Urban Railway Train
Module level, if applicable	
Code, if applicable	109135
Subtitle, if applicable	
Semester(s) in which the module is taught	5th semester
Person responsible for the module	Professor ZHENG Shubin
Lecturer	Professor ZHENG Shubin Lecturer PENG Lele Lecturer ZHONG Qianwen
Language	Chinese
Relation to curriculum	This course is a special compulsory course and one of the core courses for tVehicle Engineering (Rail Transit Vehicle) of the School of Urban Rail Transportation. This course enables the students to acquire fundamental engineering knowledge and basic theoretical knowledge for vehicle engineering program, understand new developments and trends in the field of vehicle engineering, and cultivate the ability of systematic expression, modeling, analysis for solution, and reasoning.
Type of teaching, contact hours	Target students: sophomores of Vehicle Engineering (Rail Transit Vehicle) Type of teaching: theoretical teaching Contact hours: 32 hours Of which Theoretical teaching: 32 hours Experiment/practice teaching: 0 hours Size of class: up to 50 students for theoretical teaching

Workload	Workload = 60 hours Contact hours = 32 hours Self-study hours = 28 hours
Credit points	2.0
Requirements according to the examination regulations	Only students with class attendance rate over 2/3 and assignment completion rate over 2/3 are allowed to take the exam.
Recommended prerequisites	Fundamentals of Computer Applications, Automatic Control Theory
Module objectives/intended learning outcomes	**Learning outcomes:** The task of this course is to enable students, through teaching, to learn the basic knowledge of engineering, to cultivate the ability of applying the knowledge of mathematics, natural science and mechanical engineering sciences, the ability to formulate experiment schemes, conduct experiments, and to analyze and interpret data, as well as calculation and testing skills and computer operation abilities. Specific objectives include: ● **Knowledge:** 1. Basic composition of network structure, development trends of network control technology of train for urban rail transit. 2. Network control technology of trains and its mathematical model ● **Skills:** 1. Ability to apply relevant basic engineering and professional knowledge in analyzing various engineering phenomena in vehicle engineering to solve actual problems in engineering applications. 2. Possess professional knowledge of analyzing and solving practical problems in vehicle engineering, able to calculate and test for complex

	vehicle engineering inspection and monitoring problems and understand its limitations, and be able to be innovative in the design process. ● **Competence:** 1. Master related concepts and basic principles of mechanics, electronics, control, etc. and have basic engineering knowledge. Be able to continuously analyze, summarize, judge and reason about engineering phenomena according to the characteristics of vehicle engineering to understand engineering problems. 2. Acquire comprehensive knowledge of vehicle inspection Be able to reasonably analyze and evaluate actual problems and provide valuable solutions using engineering background knowledge.
Contents	**Theoretical teaching** (32 contact hours; 28 self-study hours) **Chapter I Network Control System of Train Overview** (4 contact hours; 2 self-study hours) Basic concept of network control system; Basic trend of the development of typical train network control system; Control network and information network: Connection and difference between control network and information network**; Composition structure and hierarchical model of control network*. **Chapter II Fundamentals of Network Communication and Computer Control** (6 contact hours; 6 self-study hours) Concept of network communication: Understand the composition and logical structure of computer network.*; Network interconnection reference

	model**; Data communication: Network structure, data transfer and exchange technology*; Network architecture: Data coding and modulation technology*; **Chapter III Communication Network of Train for Urban Rail Transit** (8 contact hours; 8 self-study hours) LonWorks network**: Static characteristic parameters of the test device*; ARCNET network**: CAN bus*; Train Communication Network (TCN)**; Industrial Ethernet **Chapter IV Network Control System of Train for Urban Rail Transit** (6 contact hours; 6 self-study hours) Train microcomputer control system**: Tasks and functions of the train network system*; Train control and management system: Structure and composition of SIBAS, MITRAC and AGATE systems*; Basic structure and composition of TIS and DETECS systems*; Train communication control system: Topology of network control system*. Equipment operational management*: Structure, function and principle of train communication control system. **Chapter V Train Operation Control System** (4 contact hours; 4 self-study hours) Automatic Train Control (ATC) system**: Structure and function of automatic train control system; Automatic Train Protection (ATP) system: Automatic Train Operation (ATO) system*; Automatic Train Supervision (ATS) system:

	Communication-Based Train Control (CBTC) system*; **Chapter VI Network Based Train Fault Diagnosis System** (4 contact hours; 2 self-study hours) Train fault diagnosis technology; Metro vehicle fault diagnosis and information management system*; CAN-based maglev vehicle-mounted network monitoring and diagnosis system**. TCN-based train fault diagnosis system*.
Study and examination requirements and forms of examination	Final score includes: attendance (10%), performance (30%) and final exam (60%). Specific requirements are as follows: 1. Attendance (10%): no late arrivals, no early departures, and no unauthorized absences; 2. Assignments (30%): homework, experiment reports; 3. Final assessment (60%): final exam.
Media employed	Multimedia computers, projectors, laser pointers, blackboards, chalks
Reading list	1. Required books [1] NI Wenbo, WANG Xuemei. *High Speed Train Network and Control Technology* Chengdu: Southwest Jiaotong University Press, May 2008 [2] REN Bo, QIAO Li, LI Huan. *Fieldbus Technology and Applications.* Beijing: Aviation Industry Press, July 2008 [3] LIU Zhiming, SHI Hongmei. *D-Series High Speed Train Equipment.* Beijing: China Railway Publishing House, August 2000

Note: In Contents,** for key knowledge points, * for important knowledge points, and the rest for general information.