

05 Objectives & Learning Outcomes

abstract : This program is the curriculum for the Electrical (Power) Engineering and Its Automation major at Changchun Institute of Technology, designed to cultivate high-quality applied professionals with well-rounded development in moral, intellectual, physical, aesthetic, and labor education, all grounded in the power system. Through systematic study of mathematics, natural sciences, engineering fundamentals, and specialized courses, students will master core knowledge and skills in electrical engineering while developing strong practical abilities, innovative thinking, and an international perspective.

1.train objective

This programme adheres to the fundamental mission of fostering talents for the nation. Against the engineering application background of the new-type power system and in support of China's national "Dual Carbon" strategic goals, it aims to cultivate high-quality application-oriented talents with all-round development in morality, intellect, physical fitness, aesthetic attainment and labour awareness. Graduates shall possess solid theoretical foundations, strong engineering-practice capabilities, innovative application capabilities, an international view and a strong sense of social responsibility. They shall be capable of adapting to socio-economic development and competent for jobs related to power systems, including engineering design, technical retrofitting, installation and commissioning, operation and maintenance, inspection and testing, information processing, engineering management and market trading, as well as emerging digital-intelligent fields. After approximately five years of continuous learning and engineering practice upon graduation, graduates are expected to grow into technical and managerial backbones in the power industry. The specific competence indicators are listed below:

(1) Master relevant national and power-industry guidelines, policies, laws and regulations. Possess high ideological-political awareness and good humanistic and social-science literacy, understand and practice engineering ethics, demonstrate a sense of social responsibility and professional engineering morality, and develop comprehensive qualities adapted to high-quality socio-economic development.

(2) Possess the competence to identify, formulate, analyse, investigate and solve complex electrical engineering problems by applying knowledge of mathematics, natural sciences, computing, engineering fundamentals, specialized expertise, as well as engineering-related safety, legal, environmental, economic, management and marketing knowledge with the aid of modern tools. Be capable of designing and effectively implementing solutions for complex electrical engineering problems that meet sustainability requirements.

(3) Possess strong team awareness and coordination capabilities, and be able to manage multidisciplinary projects under the constraints of legal, ethical, social, environmental and economic considerations.

(4) Possess the international view of an electrical engineer, keep abreast of domestic and international development status in electrical engineering, and be capable of effective communication, exchange and cooperation with professional peers and the general public in cross-cultural contexts.

(5) Possess innovative awareness, be familiar with innovative methods and approaches, and have the capability for research-and-development and technical retrofitting of electrical systems, units and devices.

(6) Possess the awareness and capability for lifelong learning and critical thinking, be able to proactively adapt to the development of the power industry, and continuously follow cutting-edge new technologies and new business forms in the discipline.

2.subject-specific criteria

The discipline-specific standards of electrical engineering and automation fully reflect the requirements of knowledge and understanding, interdisciplinary ability, engineering methodology, engineering development, engineering practice and product development.

Standard 1 (Engineering Knowledge): Be able to apply knowledge of mathematics, natural sciences, computing, engineering fundamentals and specialized electrical engineering knowledge to solve complex electrical engineering problems.

Standard 2 (Problem Analysis): Be able to apply fundamental principles of mathematics, natural sciences and engineering sciences to identify, judge and formulate complex electrical engineering problems. Through literature research and analysis, take sustainability

requirements into comprehensive consideration to draw valid conclusions.

Standard 3 (Design/Development of Solutions): Be able to design solutions for complex electrical engineering problems taking social, health, safety, legal, cultural and environmental factors into account. Capable of designing electrical systems, units and devices for specific requirements, incorporating innovation in the design process. Furthermore, capable of evaluating feasibility from the perspectives of life-cycle cost, net-zero carbon requirements, legal compliance and engineering ethics.

Standard 4 (Research): Be able to investigate complex electrical engineering problems based on scientific principles and scientific methods by designing experiments, analysing and interpreting data, and synthesizing information, so as to reach reasonable and valid conclusions.

Standard 5 (Using modern tools): Be able to develop, select and apply appropriate technologies, resources, modern engineering tools and information-technology tools to test, analyse, calculate, predict and simulate complex electrical engineering problems, and understand their limitations.

Standard 6 (Engineering and Sustainability): Be able to reasonably analyse and properly evaluate the impacts of electrical-engineering-related professional practices and complex engineering problems on health, safety, environment, legislation, economy and social sustainable development, based on practical application scenarios and domain knowledge of electrical engineering projects, and understand the corresponding responsibilities to be assumed.

Standard 7 (Engineering Ethics and Professional Codes): Be imbued with the awareness of serving the country through engineering and benefiting the people, and possess humanistic and social-science literacy. Able to understand the social responsibilities of electrical engineers concerning public safety, health, well-being and environmental protection; able to understand and practice engineering ethics, consciously abide by professional engineering ethics, codes and relevant laws in engineering practice, and fulfil social responsibilities.

Standard 8 (Individual and Team): Be equipped with strong team awareness and collaborative spirit. Capable of acting as an individual contributor, team member and team leader within diverse multidisciplinary teams, and competent in responding to unexpected emergencies.

Standard 9 (Communication): Be able to communicate effectively with industry peers and the general public on complex electrical engineering problems. Be capable of making presentations, articulating ideas clearly and responding to questions. Be competent in drafting official documents, engineering reports and design documents. Possess an international view in electrical engineering, be able to communicate in cross- cultural contexts, and understand and respect linguistic and cultural differences.

Standard 10 (Project Management): Understand and master management principles and economic-decision-making methods involved in electrical engineering projects, and be capable of applying them in multidisciplinary environments.

Standard 11 (Lifelong Learning): Possess the awareness and competence for autonomous learning, lifelong learning and critical thinking. Understand the impacts of broad-ranging technological changes on engineering and society, adapt to new technological transformations, and keep abreast of the latest theories, technologies and international cutting- edge developments in electrical engineering.

3.Contact Hours and Credit Points

Minimum graduation requirement: 166 credits (ECTS Credit=215) ;

The minimum graduation requirement is 2046 contact hours.

The minimum graduation requirements for four-year undergraduate students are 166 credits (215 ECTS credits), comprising: 25 credits (25 ECTS credits)for Mathematics and Natural Sciences, 48 credits (70.5 ECTS credits)for Engineering and Related Disciplines, 42 credits (63.5 ECTS credits)for Engineering Practice and Graduation Design, 43 credits (48 ECTS credits)for Humanities and Social Sciences, and 8 credits for Extracurricular Quality Development. The total required credits for graduation are 151.5, with 14.5 credits allocated to electives (including 2 credits for university-wide general education electives).

4.system of education and degree

Standard academic system: Full-time undergraduate program with a standard duration of four years, and an extended duration of 3 to 6 years is permitted.

Degree: Bachelor of Engineering.

5.Core disciplines and curriculum system

5.1.Core disciplines

Electrical Engineering

5.2.main course

Advanced Mathematics, College English, Complex Functions, Signals and Systems, Electromagnetic Fields, Circuit Theory, Analog Electronics, Digital Electronics, Electrical Machinery, Power Electronics, Automatic Control Principles, Microcontroller Principles and Applications, PLC Principles and Applications, Power System Analysis, Power System Relay Protection, Power Plant Electrical Engineering, High Voltage Technology, etc.

5.3.Main Practical Sessions

Electrical circuit training, electronic process internship, power system simulation practice, comprehensive practice of electrical engineering, professional orientation internship, power system analysis course design, power electronics technology course design, microcontroller application technology practice, PLC control system practice, production internship, electrical CAD application training, graduation project, etc.

6.The Relationship Matrix of Training Objectives,Subject Specific Standards and Curriculum System

6.1.Supporting the Training Objectives Matrix with Graduation Requirements

train objective Graduation requirements	target① Serve society	target② Professional Competence	target③ decision-making management	target④ international view	target⑤ Research Innovation	target⑥ autonomic learning
subject-specific criteria1		H				
subject-specific criteria2		H			H	
subject-specific criteria3		H			H	
subject-specific criteria4		H			H	
subject-specific criteria5		M			H	H
subject-specific criteria6	H					
subject-specific criteria7	H					
subject-specific criteria8	M		H	M		
subject-specific criteria9			H	H		M
subject-specific criteria10			H			
subject-specific criteria11				M	M	H

Note: H (High relevance) 、 M (Relevance) 、 L (Low relevance)

6.2.The Curriculum System Supports the Specific Standard Matrix of the Subject

index point Pedagogical practices	Standard 1				Standard 2				Standard 3				Standard 4				Standard 5			Standard 6		Standard 7			Standard 8		Standard 9			Standard 10		Standard 11	
	1-1	1-2	1-3	1-4	2-1	2-2	2-3	2-4	3-1	3-2	3-3	3-4	4-1	4-2	4-3	4-4	5-1	5-2	5-3	6-1	6-2	7-1	7-2	7-3	8-1	8-2	9-1	9-2	9-3	10-1	10-2	11-1	11-2
Ideological and Moral Education and the Rule of Law																						H											
Essentials of Chinese Modern History																						H											
Introduction to the Basic Principles of Marxism																						H											
An Introduction to Mao Zedong Thought and the Theoretical System of Socialism with Chinese Characteristics																						H											
An Introduction to Xi Jinping's Thought on Socialism with Chinese Characteristics for a New Era																				H	H												
Current Situation and Policies																						H											
college English																													H				
College Physical Education and Health																								H									

index point Pedagogical practices	Standard 1				Standard 2				Standard 3				Standard 4				Standard 5			Standa rd6		Standard 7			Standa rd8		Standard 9			Standa rd10		Standa rd11	
	1-1	1-2	1-3	1-4	2-1	2-2	2-3	2-4	3-1	3-2	3-3	3-4	4-1	4-2	4-3	4-4	5-1	5-2	5-3	6-1	6-2	7-1	7-2	7-3	8-1	8-2	9-1	9-2	9-3	10-1	10-2	11-1	11-2
military theory																						H											
engineering ethics																				H			H										
Mental Health Education for College Students																								H									
Learning to Dream																						H											
General Literacy and Practice of Artificial Intelligence				H														H															
College Students' Career Guidance and Career Planning																							H										
Party History (History of New China, Reform and Opening-up, and Socialist Development)																						H											
Entrepreneurship foundation																									H	H							M
Innovative Methods and Practice																									H	H							
higher mathematics I-3	H																																
linear algebra II	H																																
Probability Theory and	H																																

index point Pedagogical practices	Standard 1				Standard 2				Standard 3				Standard 4				Standard 5			Standard 6		Standard 7			Standard 8		Standard 9			Standard 10		Standard 11	
	1-1	1-2	1-3	1-4	2-1	2-2	2-3	2-4	3-1	3-2	3-3	3-4	4-1	4-2	4-3	4-4	5-1	5-2	5-3	6-1	6-2	7-1	7-2	7-3	8-1	8-2	9-1	9-2	9-3	10-1	10-2	11-1	11-2
Mathematical Statistics I																																	
University Physics Experiment III													H	H	H																		
college physics I	H																																
complex variable function	H																																
Introduction to Environmental Science																				H													
engineering drawing																											H						
Fundamentals of Computer Programming (C)																	H	H															
circuit theory		H												M	M	M																	
Analog Electronic Technology		H		M										M	M																		
digital electronic technology		H		M										M		M																	
electromagnetic field		H																															
Signals and Systems		H			H																												
Introduction to Electric Power Engineering																				H							H						

index point Pedagogical practices	Standard 1				Standard 2				Standard 3				Standard 4				Standard 5			Standard 6		Standard 7			Standard 8		Standard 9			Standard 10		Standard 11	
	1-1	1-2	1-3	1-4	2-1	2-2	2-3	2-4	3-1	3-2	3-3	3-4	4-1	4-2	4-3	4-4	5-1	5-2	5-3	6-1	6-2	7-1	7-2	7-3	8-1	8-2	9-1	9-2	9-3	10-1	10-2	11-1	11-2
Electromechanics					H	H	H																										
principle of automatic control		H	H	H																													
power electronic technology						H	H								H	H																	
Foundation and Application of Microcontroller							H							M	M	M																	
Principle and Application of PLC			H		H		H								H																		
power system analysis				H	H	H		H																						H			
power system relay protection					H	H		H																									
power plant electrical engineering									H	H	H	H																					
high voltage technique					H		H	H																				H					
electricity market																														H	H		
Power Technology Economics and Management																														H	H		

index point Pedagogical practices	Standard 1				Standard 2				Standard 3				Standard 4				Standard 5			Standa rd6		Standard 7			Standa rd8		Standard 9			Standa rd10		Standa rd11	
	1-1	1-2	1-3	1-4	2-1	2-2	2-3	2-4	3-1	3-2	3-3	3-4	4-1	4-2	4-3	4-4	5-1	5-2	5-3	6-1	6-2	7-1	7-2	7-3	8-1	8-2	9-1	9-2	9-3	10-1	10-2	11-1	11-2
power system automation				H	H																												
New Energy Power Generation and Comprehensive Utilization of Energy							H																										
Special Topic on New Technologies in Electrical Engineering																											H						
Fault Diagnosis and Condition Monitoring of Electrical Equipment																H	H																
Applications of Artificial Intelligence in Electrical Engineering																			H														H
Military skills																							H										
Basic Computer Practice in University																		H															
Professional awareness internship																			H			H					H						
Circuit Training													H																				

index point Pedagogical practices	Standard 1				Standard 2				Standard 3				Standard 4				Standard 5			Standa rd6		Standard 7			Standa rd8		Standard 9			Standa rd10		Standa rd11		
	1-1	1-2	1-3	1-4	2-1	2-2	2-3	2-4	3-1	3-2	3-3	3-4	4-1	4-2	4-3	4-4	5-1	5-2	5-3	6-1	6-2	7-1	7-2	7-3	8-1	8-2	9-1	9-2	9-3	10-1	10-2	11-1	11-2	
engineering training													H												H									
Electronic Technology Practice													H				H																	
Application Technology Practice of Single Chip Microcomputer										H	H								H								M							
Power System Analysis Course Design									H	H																H							H	
Comprehensive Practice of Electrical Engineering													H	H	H	H	H																	
Practice of PLC Control System											H						H								M		M							
Course Design of Electrical Engineering in Power Plant									H	H																	H						H	
Power Electronics Technology Course Design									H	H									H															H
Professional English Practice																											H	H						
Electricity CAD																										H								

index point Pedagogical practices	Standard 1				Standard 2				Standard 3				Standard 4				Standard 5			Standa rd6		Standard 7			Standa rd8		Standard 9			Standa rd10		Standa rd11		
	1-1	1-2	1-3	1-4	2-1	2-2	2-3	2-4	3-1	3-2	3-3	3-4	4-1	4-2	4-3	4-4	5-1	5-2	5-3	6-1	6-2	7-1	7-2	7-3	8-1	8-2	9-1	9-2	9-3	10-1	10-2	11-1	11-2	
Application Training																																		
Power System Simulation Practice																	H	H	H															
Comprehensive Practice in Electrical Safety and Emergency Rescue												H								H		H												
Electricity Production Practice																				H		H				H	H							
graduation project									H	H	H	H						H									H		H				H	
Writing and Communication																											H		L					
Artistic Experience and Expression																						M												
Aesthetic Education in Universities																						M												
Labor Education and Practice																						M												
Innovation and entrepreneurship practice																									H	H								
social practice																						H											M	

index point Pedagogical practices	Standard 1				Standard 2				Standard 3				Standard 4				Standard 5			Standard 6		Standard 7			Standard 8		Standard 9			Standard 10		Standard 11	
	1-1	1-2	1-3	1-4	2-1	2-2	2-3	2-4	3-1	3-2	3-3	3-4	4-1	4-2	4-3	4-4	5-1	5-2	5-3	6-1	6-2	7-1	7-2	7-3	8-1	8-2	9-1	9-2	9-3	10-1	10-2	11-1	11-2
club events, association activity																									H								

notes: In the table “H (high) ”、“M (centre) ” “L (low) ”It indicates the relevance of the course to the graduation requirements.

7.Teaching Schedule

Course Category		Nature of the course	Course ID	course title	period			credit	Semester of the course		Europe	remarks
					total class hours	Theoretical class hours	Practical class hours			study independently	Total Credits	
General Education Courses in Humanities and Social Sciences (830 class hours, 43 credits)	Public Compulsory Course (734 class hours, 37 credits)	obligatory	my01031010	Ideological Moral Cultivation and Legal Basis	48	40	8	3	2	42	3	
			my02051010	Conspectus of Chinese Modern History	48	40	8	3	1	42	3	
			my03041010	Fundamentals of Marxism	48	40	8	3	3	42	3	
			my04011010	Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era	48	32	16	3	5	42	3	
			my04212010	Introduction to Mao Zedong Thought and the Theoretical	48	40	8	3	4	42	3	

		System of Socialism with Chinese Characteristics								
	my05011011-8	Current Situation and Policies	64	56	8	2	1-8	0	2	
	wy01101011-3	College English 1-3	128	128		8	1-3	112	8	
	ty01012011-5	College Physical Education and Health 1-5	144	144		2	1-4	0	4	
	ty04012010	military theory	36	36		2	1	0	2	
	wz01601010	Military skills	3 weeks			2	1	0	4	
	xl01021010	Mental Health Education for College Students	36	24	12	2	1	24	2	
	jg05581010	General Literacy and Practice of Artificial Intelligence	16	10	6	1	2	14	1	
	dq02281011	Career Guidance and Career Planning for College Students I	18	18		0.5	2	12	1	
	dq02281012	Career Guidance and Career Planning for College	20	20		0.5	5	10	1	

				Students II								
			my03061010	National Security Education	16	16		1	4	14	1	
			dq02911010	Engineering Ethics	16	16		1	3	0	1	
			summation		734	660	74	37		396	42	
	University-wide General Education Elective Courses (96 class hours, 6 credits)	take as an elective course	my04031020	Learning to Build Dreams Elective Course	16	16		1	1	14	1	
			my02031020	Party's history	16	16		1	2	14	1	4 out of 1
			my02041020	New History of China	16	16		1	2	14	1	
			my04051020	History of Reform and Opening-up	16	16		1	2	14	1	
			my03031020	History of Socialist Development	16	16		1	2	14	1	
			sc01012020	Entrepreneurship foundation	16	16		1	4	14	1	
			sc01022020	Innovative Methods and Practice	16	16		1	3	14	1	
				General Education Elective Courses	32	32		2	1-8	60	2	
			summation		96	96	0	6.0		116	6.0	

Mathematics and Natural Science Courses (400 class hours, 25 credits)	Mathematics, Physics, Chemistry, Environment and Sustainable Development	obligatory	lx01013011-2	Advanced Mathematics I-3	152	152	0	9.5	1-2	133	9.5	
			lx02022010	linear algebra II	40	40	0	2.5	2	35	2.5	
			lx02032010	Probability Theory and Mathematical Statistics I	48	48	0	3.0	3	42	3.0	
			lx03023010	University Physics Experiment III	24	24	0	1.5	4	21	1.5	
			lx03015011-2	College Physics I	88	88	0	5.5	2-3	77	5.5	
			lx02041010	Complex function	32	32	0	2	3	28	2	
			sz03501010	Introduction to Environmental Science	16	16	0	1.0	1	14	1.0	
			summation		400	400	0	25		350	25	
Engineering Foundation Courses (288 class hours, 18 credits)	Add notes to core professional courses★	obligatory	jd01204010	engineering drawing	32	32	0	2	2	58	3	
			jg05122010	Fundamentals of Computer Programming (C)	40	20	20	2.5	2	65	3.5	
			dq01022010	Electric Circuit Theory	72	58	14	4.5	3	138	7	★
			dq01032010	Analog Electronic Technology	48	42	6	3	4	87	4.5	
			dq01042010	digital electronic	40	32	8	2.5	5	65	3.5	

Professional Foundation Courses (248 class hours, 15.5 credits)				technology								
			dq04013010	Signals and Systems	24	24	0	1.5	4	21	1.5	
			lx03032010	electromagnetic field	32	32	0	2.0	4	58	3	
			summation		288	240	48	18		492	26	
		obligatory	dq02102020	Introduction to Electric Power Engineering	24	24	0	1.5	3	36	2	
			dq02017010	Theory of Electrical Machine	56	56	0	3.5	4	109	5.5	★
			dq03012010	Principle of Automatic Control	32	32	0	2	4	58	3	
			dq03054020	Foundation and Application of Microcontroller	32	26	6	2	5	28	2	
			dq03033010	power electronic technology	40	34	6	2.5	5	80	4	★
			dq02021010	power system analysis	64	64	0	4	5	116	6	★
			summation		248	236	12	15.5		427	22.5	

Professional courses (128 class hours, 4 credits)		obligatory	dq02031010	power system relay protection	48	48	0	3	6	102	5	★
			dq02061010	power plant electrical engineering	40	40	0	2.5	6	80	4	★
			dq02046010	high voltage technique	40	40	0	2.5	6	80	4	★
			summation		128	128	0	8		262	13	
Program Features (104 credit hours, 6.5 credits)	Professional Development Courses: Cross-disciplinary Courses (24 hours,1.5 credits)	obligatory	dq02901010	Power Technology, Economics and Management	24	24	0	1.5	6	36	2	
			summation		24	24	0	1.5		36	2	
	Professional Development Course (80 hours, 5credits)	take as an elective course	dq03074020	Principle and Application of PLC	32	26	6	2	5	58	3	3 out of 1
			dq02051020	power system automation	24	24	0	1.5	7	36	2	
			dq02841020	Fault Diagnosis and Condition Monitoring of Electrical Equipment	24	24	0	1.5	7	36	2	
			dq02352020	Applications of Artificial Intelligence in Electrical	24	24	0	1.5	7	36	2	

				Engineering									
			dq02291020	electricity market	24	24	0	1.5	6	36	2	3 out of 1	
			dq02331020	Special Topic on New Technologies in Electrical Engineering	24	24	0	1.5	6	36	2		
			dq02341020	New Energy Power Generation and Comprehensive Utilization of Energy	24	24	0	1.5	6	36	2		
			summation		80	80	0	5		130	7		
Engineering Practice and Graduation Project (Thesis) (42 credits)	Main Practical Teaching Components	obligatory	Course ID	Project Name	number of weeks			credit	Semester of the course				remarks
			yg04601010	Basic Computer Practice in University	1			1.0	2	25	1.5		
			dq02601010	Professional Cognition Practice	1			1.0	3	25	1.5		
			dq01621010	Circuit Training	1			1.0	3	25	1.5		
			gx00611010	engineering training	1			1.0	5	25	1.5		

			dq01611010	Electronic Technology Practice	2	2.0	4	50	3	
			dq03604010	Application Technology Practice of Single Chip Microcomputer	1	1	5	25	1.5	
			dq02621010	Power System Analysis Course Design	2	2.0	5	58	3	
			dq03913010	Power Electronics Technology Course Design	1	1.0	5	29	1.5	
			dq03624010	Practice of PLC Control System	2	2.0	7	50	3	
			dq02651010	Power System Simulation Practice	2	2.0	7	50	3	
			dq02611010	Course Design of Electrical Engineering in Power Plant	2	2.0	7	58	3	

			dq02761010	Practice of English for Electrical Engineering	1	1.0	7	25	1.5	
			dq02461010	Comprehensive Practice of Electrical Engineering	5	2.0	7	125	7.5	
			dq02501010	Comprehensive Practice in Electrical Safety and Emergency Rescue	1	1.0	7	25	1.5	
			dq02681010	Electricity Production Practice	3	3.0	7	75	4.5	
			jd01841010	Electricity CAD Application Training	1	1.0	7	25	1.5	
			dq02692010	graduation project	15	15.0	8	450	23	
			summation		42	42.0		1145	63.5	
Second Classroom Quality Development (8 credits)		obligatory	Course ID	Project Name	Class hours or weeks	credit	Semester of the course			remarks
			tw01601010	social practice	16	1	1-8	14	1	
			ts02601010	Labor Education and Practice	32	1	6	0	1	

		sc01601010	Innovation and Entrepreneurship Practice	32	2.0	1-8	28	2.0	
		gj01021010	Writing and Communication	16	1.0	2	14	1.0	
		ml01021010	Artistic Experience and Expression	16	1	3	14	1	
		ml01011010	Aesthetic Education in Universities	16	1	3	14	1	
		tw01611010	Club activities	16	1.0	1-8	14	1.0	
		summation		144	8		98	8	
summation			2046 credit hours/50 weeks		166.0		3452	215.0	

8.Teaching Process Diagram

Fig. 1 Teaching process diagram of the course



