

# Training objectives of Electrical engineering and automation based on Professional certification of Engineering education

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### Abstract

*This paper introduces the evaluation and revision of talent training objectives of electrical engineering and automation of Yangtze University based on the certification standard of engineering education. The revised talent training objectives are in line with the talent training orientation of Yangtze University, meet the needs of social and economic development, form a talent training objective with distinctive professional characteristics and high social recognition, and ensure that the training of engineering and technical talents conforms to international standards.*

### Key words

*Professional certification, Engineering education, Training objectives, Electrical engineering and automation*

### I. Introduction

Professional certification of engineering education has been implemented in many countries, and the role of professional certification in promoting engineering education has also been confirmed. It is of great significance to establish the professional certification system of engineering education to improve the international competitiveness of engineering education and ensure the quality of engineering education [1]. In the 1990s, China began to carry out professional certification of engineering education from architecture majors. In 1994, "the Provisional Regulations on the Evaluation of Construction Professional Education in Colleges and Universities" were promulgated and implemented, which made the certification of engineering education professional scientific, legal, standardized and institutionalized [2,3]. In 2006, with the approval of the Higher Education Department of the Ministry of Education, the "Pilot Working Group for Certification of Electronic Information and Electrical Engineering" was established [4], to carry out the

certification of electrical engineering and automation, electronic information engineering, electronic science and technology, communication engineering, optoelectronic information engineering, automation, etc. [5,6].

In 2020, the National Engineering Certification Committee approved the professional certification project for electrical engineering and automation of Yangtze University. According to the China Engineering Education Certification Standard, the talent training objectives of the 2016 electrical engineering and automation have been revised, and the talent training objectives of the 2020 electrical engineering and automation have been formulated.

### II. Evaluation and revision of talent training objectives

#### 2.1 Evaluation on the rationality of training objectives

In December 2019, the rationality evaluation of the 2016 talent training objectives was launched to provide modification opinions and basis for the revision of the 2020 talent training objectives.

##### (1) Employers' evaluation of the rationality of training objectives

Distribute the questionnaire of "Employers' Evaluation on the Rationality of the 2016 Training Objectives and Graduates' Competence" to the heads of the employing units where the students have graduated for five years. The positions of the person filling in the questionnaire include general manager, professional technical personnel, department manager, human resources management personnel, etc. The survey units cover Hubei, Guangdong, Zhejiang, Jiangsu, Henan and other provinces; Student employment is mainly distributed in the power industry, petroleum and petrochemical, electrical equipment manufacturing and other industries.

The employer evaluated the 2016 training objectives and graduates' abilities, and the statistical analysis of the questionnaire is shown in Table 1.

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**Table1 Employers' evaluation statistics**

Evaluation content of training objectives	Average (Full 5)
Overall evaluation of training objectives	4.5
Training objectives adapt to economic and technological development and meet the needs of enterprise talents	4.5
Training objectives adapt to national and local development and change	4.4
Training objectives serve regional economic and social development	4.4
Training objectives adapt to the development trend of globalization	4.4
Graduates' professional knowledge and professional competitiveness	4.7
Entrepreneurship and innovation ability of graduates	4.6
Graduates' humanistic quality and professional ethics	4.6
Graduates' teamwork spirit and project management ability	4.7
Graduates' professional vision and autonomous learning ability	4.7

## (2) Industry experts' evaluation on the rationality of training objectives

**Table2 Statistics of industry experts' evaluation**

Evaluation content of training objectives	Average (Full 5)
Overall evaluation of training objectives	4.3
Training objectives adapt to economic and technological development and meet the needs of enterprise talents	4.3
Training objectives adapt to national and local development and change	4.3
Training objectives serve regional economic and social development	4.3
Training objectives adapt to the development trend of globalization	4.2
Consistency between training objectives and school positioning	4.2

Distribute the rationality evaluation questionnaire of the 2016 level talent training objectives to experts in the power industry, scholars in the electrical engineering department of well-known universities in China, and outstanding alumni representatives. The technical title of the person filling in the questionnaire includes professor, associate professor, senior engineer, etc., and the administrative title of the person filling in the questionnaire includes president, general manager, director, etc; The respondents' work units include enterprises, universities and public institutions. Table 2 shows the statistical results of "industry experts'

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evaluation on the reasonableness of the 2016 level training objectives".

## (3) Students' evaluation of the rationality of training objectives

Distribute the questionnaire survey of "students' evaluation on the reasonableness of the 2016 level training objectives" to the students in this major. The statistical results of the questionnaire are shown in Table 3.

**Table3 Statistics of students' evaluation**

Evaluation content of training objectives	Average (Full 5)
Overall evaluation of training objectives	4.6
Training objectives adapt to economic and technological development and meet the needs of enterprise talents	4.6
Training objectives adapt to national and local development and change	4.5
Training objectives serve regional economic and social development	4.5
Training objectives adapt to the development trend of globalization	4.5
Consistency between training objectives and school positioning	4.5
Consistency between training objectives and professional expectations	4.6

## (4) Evaluation of the rationality of the training objectives by this year's graduates

**Table4 Statistics of this year's graduates' evaluation**

Evaluation content of training objectives	Average (Full 5)
Overall evaluation of training objectives	4.5
Training objectives adapt to economic and technological development and meet the needs of enterprise talents	4.6
Training objectives adapt to national and local development and change	4.5
Training objectives serve regional economic and social development	4.6
Training objectives adapt to the development trend of globalization	4.5
Consistency between training objectives and school positioning	4.6
Consistency between training objectives and professional expectations	4.5

The questionnaire survey of "This Year's Graduates' Evaluation on the Rationality of the 2016 Training Objectives" was distributed to this year's graduates. The statistical results of the questionnaire survey are shown in Table 4.

## (5) Evaluation of the rationality of the training objectives by previous graduates

The questionnaire survey of "Previous Graduates' Evaluation on the Rationality of the 2016 Training Objectives" was distributed to previous graduates. The statistical results of the questionnaire survey are shown in Table5.

**Table5 Statistics of previous graduates' evaluation**

Evaluation content of training objectives	Average (Full 5)
Overall evaluation of training objectives	4.5
Training objectives adapt to economic and technological development and meet the needs of enterprise talents	4.5
Training objectives adapt to national and local development and change	4.5
Training objectives serve regional economic and social development	4.6
Training objectives adapt to the development trend of globalization	4.5
Consistency between training objectives and school positioning	4.6
Consistency between training objectives and professional expectations	4.5

## 2.2 Analysis of the rationality of the 2016 training objectives and revision of the training objectives

Employers, industry experts and alumni have put forward a lot of valuable opinions and suggestions on the 2016 level training objectives, which are mainly reflected in the following aspects:

(1) Cultivate socialist builders with all-round development of morality, intelligence, physique, beauty and labor, have a sense of social responsibility and actively serve the country.

(2) Have broad theoretical knowledge and professional vision.

(3) It should serve the local economic construction and the petroleum and petrochemical industry, with the professional characteristics of this specialty.

(4) It should have strong engineering practice ability.

(5) Be able to track the development of advanced technology in the industry, and have the ability of independent learning and lifelong learning.

(6) Have good humanistic quality and physical and mental health.

(7) Have the spirit of teamwork, and have the ability of effective communication and expression.

(8) Have certain organization and management ability, and can be responsible for the management of engineering projects.

(9) Serve the grassroots, be hardworking and entrepreneurial.

(10) Have certain awareness and ability of engineering innovation.

(11) Abide by professional ethics, have safety, environmental awareness and sustainable development concept.

(12) It has an international perspective, adapt to the development and changes of globalization, and adapt to the development of social economy and industry.

The evaluation of the rationality of the 2016 talent training objectives provides a basis for the revision of the 2020 talent training objectives.

## III. Talent training objectives of electrical engineering and automation under the certification standard of engineering education

### 3.1 Talent training objectives of electrical engineering and automation

According to the 2020 level talent training program for electrical engineering and automation, the training objectives are:

This major cultivates qualified socialist builders and reliable successors who develop morally, intellectually, physically and aesthetically and meet the needs of social and economic development, master the knowledge of power system, power electronics and electric drive in electrical engineering and automation, be able to engage in design, development, production, operation, maintenance and management in the field of power system, power electronics and electric drive. Based in Hubei and facing the whole country, serving the local economy and the petroleum and petrochemical industry, cultivate engineering and technical talents with entrepreneurial spirit, sense of social responsibility, and a certain sense of engineering innovation and international vision.

Graduates of this major are expected to achieve the following goals in about five years after graduation:

- (1) With a solid theoretical foundation and broad professional vision, can be engaged in the design, development, production, operation, maintenance and management of power system, power electronics and electric drive.
- (2) Be able to track the advanced technology of electrical engineering and automation, and have certain engineering practice

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innovation ability, be able to undertake technical work in the field of electrical engineering and automation, and have certain professional competitiveness in the industry.

- (3) Have healthy body and mind, good humanistic quality and sense of social responsibility, abide by professional ethics and norms, have awareness of safety and environmental protection, and can actively serve the country and society.
- (4) Have certain organizational and management skills, good team spirit, effective communication and expression skills, and can be responsible for project management.
- (5) It has a certain international vision and sustainable development concept, has independent and lifelong learning habits and ability, and can adapt to social and industrial development.

### **3.2 The consistency of training objectives with the talent training orientation of University and the needs of social and economic development**

#### **3.2.1 Relationship with talent training orientation of University**

The major of electrical engineering and automation of Yangtze University was approved by the Ministry of Education of the People's Republic of China and officially opened enrollment in 2005.

According to the talent training orientation of Yangtze University, which is "oriented to the industry, regional economy and grass-roots front-line", we will further expand our professional fields on the basis of retaining the characteristics of the industry, serving both the local economy and the industry.

Cultivate engineering and technical talents who can be engaged in system design, scientific and technological development, application research and operation management in the fields of power system, power electronics and electric drive. Graduates of the major can adapt to the development needs of electrical control such as petroleum, petrochemical and equipment manufacturing, and have good ideological and moral quality, solid foundation, wide range of knowledge, and strong practical ability. The talent training objectives of the specialty are consistent with the talent training orientation of Yangtze University.

#### **3.2.2 Relationship with the needs of social and economic development**

In the 21st century, with the rapid development of industrialization and informatization, the demand for electric power in the economic and social development is increasing, and the development potential of electric power and related industries is huge. With the development of the new energy industry and the rapid rise of the electric vehicle industry, there is a strong demand for electrical engineering and technical personnel. It is an important responsibility of colleges and universities to cultivate talents urgently needed in the region, develop emerging knowledge and serve regional economic development.

##### **(1) The needs of social and economic development**

With the rapid development of economy and the wide application of modern electrical equipment, the degree of automation of industrial production is becoming higher and higher. Enterprises and public institutions are in urgent need of technical personnel in electrical engineering and automation. Industrial electrical automation has become the foundation and leading factor of modern industrial development. The society has a great demand for the professional talents, especially the application-oriented talents.

##### **(2) Demand for industry development**

The Ministry of Education, the Ministry of Human Resources and Social Security, and the Ministry of Industry and Information Technology jointly issued "the Planning Guide for the Development of Manufacturing Talents". The total scale of talents and the total gap of talent demand in the 10 key areas of manufacturing industry such as "power equipment" in 2025 are predicted. By 2025, the total demand for "power equipment" talents will be 17.31 million, but the gap will reach 9.09 million. It can be predicted that in a long period of time in the future, the demand for talents in electrical engineering and its automation specialty will continue to increase, and the professional development prospect is broad.

The major conforms to the social development situation, clarifies the professional orientation, formulates practical training objectives, trains engineering and technical talents, transports high-quality applied talents for the development of the power equipment industry, and contributes to the sustainable development of society.

### **(3) Demand for regional economic development**

Petroleum and chemical industries are important pillar industries of industrial economy in Hubei Province. It has built oil exploration, oil refining and petrochemical production bases, and oil drilling and production equipment production bases. In these enterprises, electrical engineering and control technology play a vital role. Nitrogen fertilizer production base, phosphate fertilizer and phosphate chemical production base, fine chemical production base of pesticide, medicine and dye, and tire and rubber product production base are in urgent need of a large number of electrical engineering and automation professionals.

Hubei has built Shiyang-Wuhan Automobile Industry Cluster, Wuhan East Lake New Technology Development Zone Intelligent Equipment Manufacturing Base and Ship Production Base, and has become an equipment industry cluster with a certain scale and level. These manufacturing industries need a large number of electrical engineering professionals.

The application of electrical engineering and its automation technology can improve the technological innovation ability, adjust the industrial product structure, change the development mode, develop a low-carbon circular economy, and improve the enterprise management level.

#### **3.2.3 Disciplinary support for the major**

School of Electronics and Information of Yangtze University has set up the doctoral degree points of "oil and gas information detection and instrumentation", and the master degree points of "electrical engineering" and "electronic information". The above degree points provide a good academic support for the development of electrical engineering and automation.

The specialty of electrical engineering and automation has built electrical control laboratory, power system laboratory, relay protection laboratory, automatic detection technology laboratory, computer control technology laboratory, PTS3000 laboratory, process control laboratory, microgrid comprehensive laboratory, and power system 3D virtual simulation laboratory. Jointly built the "Yangtze University - Rockwell Automation Technology Center" and the "Research Institute for Intelligent Control and Safe Operation of Distribution Network" with enterprises. It has gradually formed four research directions: power electronics and power drive, electrical control engineering, power system automation, and electrical engineering information technology, which has promoted the overall level of electrical engineering discipline.

### **3.3 The channel of opening talent training objectives to teachers, students and society**

The major attaches importance to the publicity of the training objectives, and publicizes them to students, teachers and the public, including students' parents and employers, in a variety of channels and ways to let them understand the training objectives of the major.

#### **(1) The main channels for students to publicize the training objectives of this major are:**

- ❖ Pre-school publicity, that is, through the university's undergraduate enrollment website, enrollment brochures, and enrollment consultation meetings organized by the university, students can understand the training objectives of their major before entering school;
- ❖ Upon admission, the college will issue each new student with a copy of the latest talent training plan. Through entrance education, explain to students the connotation of training objectives and their relationship with graduation requirements;
- ❖ In classroom teaching, clarify the relationship between course learning objectives and graduation requirements and training objectives;
- ❖ Professional education: invite graduating students to explain the positioning of professional training objectives and professional requirements to students of all grades, as well as the competitive advantages of this major in society;
- ❖ Invite experts from both inside and outside the school to report professional trends, industry trends and career plans to students of all grades of the major, and strengthen students' further understanding of training objectives.
- ❖ The website of the Academic Affairs Office of Yangtze University, the website of

School of Electronic Information of Yangtze University and other information platforms open training objectives and relevant contents.

**(2) The main channels for teachers to publicize their professional training objectives are:**

- ❖ Pre job training for new teachers by school functional departments;
- ❖ The college trains new teachers;
- ❖ Concentrated teaching and discussion in the college, so that teachers can clearly understand the connotation and formulation basis of the professional training objectives.

**(3) The main channels for publicizing the training objectives of this major to the public are:**

- ❖ The school enrollment brochures, the undergraduate enrollment website and the enrollment consultation meeting organized by the school;
- ❖ Professional introduction and information release of schools and colleges;
- ❖ Employment promotion activities, employers' recruitment activities to the school;
- ❖ Professional introduction of schools, colleges and alumni in external exchanges;
- ❖ School Day, alumni return day and other activities.

#### IV. Conclusion

According to the certification requirements of the engineering education specialty, in view of the lack of training of engineering and technical talents in higher education, and in combination with the characteristics of the electrical engineering and automation of Yangtze University, the talent training objectives of the electrical engineering and automation have been revised, forming a school-running feature with bright professional characteristics and high social recognition. The

revised talent training objectives are in line with the talent training orientation of Yangtze University and meet the needs of social and economic development. The monitoring and feedback mechanism for teaching quality has been effectively operated, and teachers' teaching level and engineering practice ability have been continuously improved. The comprehensive quality and professional ability of students have been continuously improved. It ensures that the training of engineering and technical personnel conforms to international standards.

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