

# Curriculum Reform of Analog Electronics Technique for Engineering Education Professional Certification

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**Abstract:** According to the talent training orientation with complex problem analysis ability and strong engineering practice and research ability advocated by the engineering education professional certification, and the core concept of "student-centered" in the engineering education certification, the teaching reform of "modeling electricity" course for engineering education certification is carried out. Determine the training objectives of the course based on the index points to be supported by the course determined based on the graduation requirements of engineering certification in the training scheme, and then take the curriculum training objectives as the starting point to construct the way to achieve the curriculum training objectives.

**Keywords:** Engineering education professional certification; Analog circuit; Curriculum teaching reform; Graduation requirement index point

## 1. Introduction

As the main course and core basic course of electrical and electronic majors, analog circuit course has typical characteristics of outstanding engineering and practicality. It plays an important role in the training of applied and innovative talents in the field of electronic engineering. Under the background of engineering education professional certification, based on the core concept of OBE, it is of great significance to reform and explore the teaching mode of analog circuit course. The electronic information engineering major of our college formulates the support correspondence matrix of professional training objectives and curriculum system according to the social needs and the training talent orientation of our college, combined with the certification index points of professional education engineering. The research group analyzed the supporting relationship between the module electrical course and the training objectives and graduation requirements of the electronic information engineering specialty of our college, determined the training objectives of the course, defined the knowledge, ability and quality that students should have, and optimized the teaching content. In order to cultivate students' ability to solve complex engineering problems under the multi-disciplinary background, the three-level practical project was designed[1].

## 2. Construct curriculum training objectives

### 2.1 The course needs to support the level 2 index points required for graduation

According to the 12 graduation requirements put forward by the professional education engineering certification, combined with the requirements of "clear, open, measurable support and coverage" for the graduation requirements put forward in the engineering education certification standard [2], according to the training objectives of electronic information engineering and the school's school running philosophy, and according to the principle of achievement oriented (OBE) reverse design, Put forward the secondary index points under the graduation requirements that need to be supported by the module electricity course [3]:

(1) Index point (1-3): master the basic knowledge of analog circuit, digital circuit, signal and system and digital signal processing, and be able to apply it to the field of electronic information for circuit analysis and design and information detection and processing.

(2) Index point (2-1): be able to preliminarily master the basic methods and means of engineering development and design in the field of electronic information, have the ability to find and put forward

engineering problems in the field of electronic information and related disciplines, identify and judge engineering problems according to user needs, and put forward and express solutions.

(3) Index point (3-2): according to the design objectives, comprehensively consider social, health, legal, cultural and environmental factors, and use electronic technology, computer technology and information acquisition and processing technology to design solutions that meet the requirements.

(4) Index point (4-2): Aiming at the engineering problems in the field of electronic information, be able to select or design and build the experimental system based on the characteristics and performance indicators of the information system, design the experimental scheme, carry out the experiment and correctly obtain the experimental data.

(5) Index point (5-2): have engineering thinking and be able to comprehensively use modern engineering tools and information technology tools to predict, simulate, experiment, analyze and evaluate complex electronic engineering problems, so as to ensure the realization of system objectives.

(6) Index point (9-1): have team consciousness, be able to understand the responsibilities of different roles in the team, and have the spirit of cooperation.

## **2.2 Curriculum training objectives**

### **2.2.1 Basic course information**

The course of "modeling electricity" is a compulsory course for all majors in the College of intelligent and electronic engineering, and it is an important professional basic course. According to the graduation requirements, the professional curriculum system and training plan are formulated. The total credits of module electricity of electronic information engineering are 4 credits, a total of 64 class hours. The certification of engineering education focuses on the student-centered teaching mode, and the goal is whether students learn, not whether teachers talk [4]. The training of students' practical ability is one of the important teaching objectives of electrical engineering. According to the training plan of professional courses, the course team designs 48 class hours of theory courses (including 40 class hours of course theory courses and 8 class hours of three-level project theory courses) and 16 class hours of practice courses (including 8 class hours of experiment and 8 class hours of three-level project).

### **2.2.2 Curriculum training objectives and their corresponding relationship with graduation requirements**

Through the combination of theoretical study, experiment and project training of analog electronic technology, the mixed teaching mode is adopted to organize the teaching content and set the teaching situation, so that the students have the knowledge of semiconductor devices, amplification circuits, integrated operational amplifiers, feedback circuits, DC regulated power supply and other aspects, as well as the use of common electronic instruments and meters, component identification and measurementSkills in design, welding and debugging of typical analog electronic circuits and common functional circuits. For knowledge / ability, the course designs resources matching with learning tasks before / during / after class and online / offline to help students master learning content and test learning effect [5]. The corresponding relationship between the teaching objectives of the course and the index points of graduation requirements is shown in Table 1. The specific objectives of the course are divided into the following four:

(1) Course objective 1: master the basic knowledge and working principle of semiconductors, basic amplification circuits, integrated circuits and typical application circuits.

(2) Course objective 2: be able to apply the basic principles of analog circuits for circuit analysis and calculation or literature research to obtain technical solutions.

(3) Course objective 3: have engineering thinking and be able to design analog circuit system with modern tools according to technical scheme or design objectives.

(4) Course objective 4: be able to work as a team, build an experimental system based on triode / integrated chip, carry out experimental research and get effective conclusions.

*Table 1: Correspondence between curriculum objectives and graduation requirements*

Graduation requirements	Index point	Degree of support	Teaching objectives
1.Engineering knowledge: have the basic theories and technologies related to mathematics, natural science, computer and electronic information required for engineering development and design in the field of electronic information, and preliminarily have the ability to abstract, describe and model complex engineering problems in the field of electronic information.	Two pole index points 1-3	M	Course objective 1
2. Problem analysis: be able to apply the basic principles of mathematics, natural science and engineering science to carry out technical scheme analysis and feasibility analysis for the complex engineering problems of embedded system, electronic equipment, signal processing and transmission system development or integration, and obtain the technical scheme through literature research.	Two pole index point 2-1	L	Course objective 2
3. Design / development solutions: be able to design technical solutions for complex engineering problems of embedded systems, electronic information systems or functional modules for specific needs, including hardware circuits, application software and embedded programs, reflect the sense of innovation in the design link, and comprehensively consider social, health, safety, legal, cultural and environmental factors.	Two pole index point 3-2	L	Course objective 3
4. Research: be able to study complex engineering problems in the field of electronic information based on information technology and relevant scientific principles, including designing experiments, analyzing and interpreting data, and obtaining reasonable and effective conclusions through information synthesis.	II. Index points 4-2	H	Course objective 4
5. Use modern tools: be able to develop, select and use appropriate technologies, resources, modern engineering tools and information technology tools, predict, simulate and simulate complex engineering problems in the field of electronic information, and understand their limitations.	Two pole index point 5-2	H	Course objective 3
9. Individual and team: have the spirit of cooperation and team consciousness, be able to assume the roles of individual, team member and person in charge in the team under the multi-disciplinary background, and have good team cooperation ability.	Secondary index point 9-1	H	Course objective 4

Note: H stands for height, m stands for medium degree, and l stands for low degree.

### 3. Design of teaching links and teaching implementation process

In order to improve the teaching connotation of "modeling electricity", the teaching reform for engineering education certification is carried out, the syllabus is rewritten, and the teaching process is redesigned. The design of the syllabus takes the curriculum objectives as the basic starting point, constructs the curriculum teaching assessment link, takes the student's personalized development as the center, takes the student's learning output as the guidance, takes the ability training as the main line, and organically combines the offline teaching and online autonomous learning, so as to effectively help the students realize the synchronous improvement of knowledge, ability and quality. Design experiments and three-level projects according to the law of students' learning cognition and the law of engineering professional ability training, and gradually cultivate students' research and engineering practice ability and autonomous learning ability [6].

(1) Consolidate knowledge through online learning and classroom principle teaching, example explanation, practice, discussion, homework, monthly examination, etc., and master the basic knowledge of analog circuit, typical circuit and basic analysis methods.

(2) Experimental design: using the combination of online learning and experimental teaching, let students carry out experimental exploration, use the analog circuit experiment box, complete the physical circuit construction based on triode / integrated chip, and debug, analyze and verify.

(3) Level III project design: through the combination of classroom teaching, case analysis and group discussion, cooperative learning, supplemented by online Q & A, discussion, self-study after class and other links, strengthen the analysis and problem-solving methods and processes, take students

as the center, project driven, guide students to think actively, cooperate in teams, and use the learned knowledge, methods and modern tools, According to the product manufacturing process (scheme demonstration - theoretical analysis - circuit design - device selection - Welding - commissioning - acceptance), the achievements meeting the performance indexes are designed and completed in groups.

(4) Before project case design, students are required to independently install EDA simulation software, learn the use of software, use the learned knowledge and methods to design circuits, complete parameter adjustment, simulation verification, and understand its limitations.

#### 4. Design of the path to achieve the curriculum objectives

*Table 2: Achievement path of course objectives*

Course objectives	Secondary points index for graduation requirements	Reaching path
Course objective 1	Two pole index points of engineering knowledge required for graduation 1-3	Basic knowledge: through online learning and offline teaching, have the basic theoretical knowledge required for the engineering development and design of analog electronic system, and preliminarily have the ability to abstract modeling and description of engineering problems. The course objectives are consistent with the knowledge and ability required for graduation requirements, which can support graduation requirement 1 (engineering knowledge) Problem analysis: through the example explanation, problem discussion and case analysis of basic amplification circuit and typical application circuit, and the scheme demonstration of complex engineering problems of three-level projects, let students learn the application of analog circuit knowledge or identify and judge the engineering problems of analog circuit system through literature research, and carry out technical scheme and feasibility analysis, Propose solutions to engineering problems. The ability training of course objectives meets the needs of analysis ability training of graduation requirement 2.
Course objective 2:	Two pole index points of graduation requirement problem analysis 2-1	Circuit design: Through typical case analysis and design and complex engineering problems of three-level projects, students can develop and design according to specific needs or performance indicators, learn EDA software, use EDA simulation software for simulation verification, and obtain the implementation scheme design that meets the requirements. The ability cultivation of course content design and course objectives meets the design ability cultivation of graduation requirement 3. The course objective of integrating the use of modern tools with project design is the intention of the use and cultivation of modern tools in graduation requirement 5, which can be effectively supported. Experimental circuit construction, debugging and research: Student centered, team cooperation, experimental research, design typical experiments, and carry out three-level project circuit design. Consider social, health and environmental factors in the analog circuit system design of cases and level III projects. It is enough for students to build a typical application circuit experimental system based on triode / integrated chip. Design the three-level project of complex engineering problems, let students weld and debug the actual circuit, realize the achievements that meet the performance indicators of the project, cooperate and independently carry out experimental research in the process of dealing with problems, learn to use common experimental instruments, debug the actual circuit, test, experimental analysis and get effective conclusions.
Course objective 3:	Graduation requirements: two pole index points of design / development solutions 3-2 Dipolar index points of modern tools required for graduation 5-2	The course content design effectively supports the course objectives and graduation requirements 4 (Experimental Research), and can cultivate the ability of team cooperation with project driven and outcome design as the carrier, which can support graduation requirements 9 (team cooperation).
Course objective 4:	Two index points of graduation requirements research 4-2 Graduation requires two indicator points of individual and team 9-1	

Focusing on the three core concepts of "student-centered, achievement oriented and continuous improvement" of engineering education professional certification, and according to the corresponding relationship between the specified curriculum objectives and the secondary index points (observation points) of graduation requirements [7], in order to promote the achievement of secondary index points

of graduation requirements, the achievement path of curriculum objectives and graduation requirements is designed as shown in Table 2.

## 5. Conclusion

According to the reverse design of the course guided by the students' learning output in the professional certification of engineering education, this paper puts forward the idea of the course construction of "modeling electricity" for engineering certification. Revise the syllabus and determine the course objectives according to the required graduation index points of engineering certification determined by the talent training plan of electronic information engineering specialty. Optimize the teaching content according to the course objectives, determine the path to achieve the course objectives, and train them to meet the requirements of engineering education certification to train excellent engineers of electronic information technology with international vision. The implementation of engineering education certification in electronic information engineering specialty helps to improve the teaching quality, improve the teaching process, cultivate students' ability to analyze and solve complex engineering problems, and promote the continuous improvement of students' training quality.

## Acknowledgements

2018 research project on Undergraduate Teaching Reform of general higher education in Liaoning Province; Research on the quantitative evaluation method of students' learning process assessment and ability achievement based on OBE (895);

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