

Discussion on Teaching Reform of Analog Circuit Course for Overseas Students

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Abstract—With the implementation of China’s “The Belt and Road” strategy, more and more overseas students will enter universities in China. In view of the current teaching situation and characteristics of the overseas students in our university, and combining with the characteristics of the Analog Circuit course, this paper makes an analysis of the teaching contents, teaching methods so as to further clarify the teaching tasks, scientifically and rationally formulate the teaching contents and improve students’ innovative ability. The proposed teaching schemes in this paper not only provide some useful ideas for the teaching of Analog Circuit course for overseas students majoring in Communication Engineering, but also provide a solid guarantee for the education of overseas students in China.

Keywords—teaching reform; Analog Circuit course; overseas students

I. INTRODUCTION

With the continuous development of China’s “The Belt and Road” strategy and the internationalization of education, China’s universities are actively carrying out international education. The number of overseas students studying in China is increasing [1]. According to the data published on the website of the Ministry of Education, 492,200 foreign students from 196 countries and regions studied in 104 universities and other teaching institutions in 31 provinces of China in 2018 [2]. While expanding the scale of overseas students, how to ensure the quality of overseas students’ diploma education needs to formulate curriculum system and management measures that meet the requirements of international education. By training high-quality overseas students, it is conducive to enhancing the international competitiveness of Chinese universities and narrowing the gap with developed countries [3].

Analog circuit is one of the most important basis courses in the major of Communication Engineering, Electronic Information Engineering, Automatic Control Engineering and other similar specialties [4]. Its teaching effect directly affects the study of the following professional courses, and plays an irreplaceable role in the cultivation of students’ basic skills and innovative ability. Therefore, it has become an important task to formulate a teaching reform program for foreign students and train high-quality foreign students [5].

II. CURRENT SITUATION OF TEACHING

Since 2014, Zhejiang University of Science and Technology has enrolled undergraduate students majoring in Communication Engineering. Since then, we have started the teaching of Analog Circuit course. Till now, there are more than 50 international students majoring in Communication Engineering from Zimbabwe, Nigeria, Congo and other countries.

A. Characteristics of Overseas Students in Our University

Compared with the Chinese students, the overseas students in our university have the following characteristics: generally have good English communication ability; active thinking, like to ask questions at any time in class; great differences in educational background and level of education; basic theoretical knowledge is not solid enough as Chinese students; like practical courses, such as experiments and projects; think highly of score, if their scores are not as high as those of their classmates, they will ask the teacher why; some students have poor discipline, always late or absent from class, poor self-control. In view of these characteristics of foreign students, effective measures should be taken to improve the quality of teaching.

B. Teachers Team Building

Our school has always paid attention to the teacher team building for foreign students’ curriculum, giving priority to the teachers with good English and overseas experience to undertake the teaching work of foreign students. Since 2017, all teachers have to pass the on-the-job examination for teaching foreign students in our university. In addition, our school also organizes oral English training courses hosted by foreign teachers every semester to improve our teachers’ ability to use English and strengthen English teaching. In order to ensure a good English skill and teaching ability of teachers to teach foreign students courses.

C. Current Situation of Teaching

English teaching of Analog Circuit course began in 2016. The students majoring in Communication Engineering are taught in English textbooks, courseware and teaching in English. From the practice of Analog Circuit course teaching, the original English textbook Electronic Devices and Circuit

Theory has been selected, and English courseware, after-class exercises and experimental guidebook have been compiled by us. The theoretical hours of the course are 48 hours and the experimental hours are 16 hours. As the English textbooks are authentic and easy to understand, it is still recommended to use the original English textbooks in all English teaching [6].

D. Existing Problems

Through three years of teaching, we find that there are some problems of this course. From the point of view of teachers, the classes are still mainly based on teachers' explanations. There is no platform for communication between students and teachers who are more in line with the learning habits of foreign students. The arrangement of practical teaching is not enough. Students can understand in class, but they cannot finish homework perfectly after class. In the experiment classes, there is a lack of design and comprehensive experiments with practical engineering background, and the experimental schedule is relatively centralized, and the teaching coherence is lacking. From the students' point of view, the course is somehow boring because the circuit is complex, various and difficult to understand. Students are lack of intuitive understanding, eager to practice by hand, but often this link is not arranged enough.

III. REFORM OF TEACHING

A. Reform of Theoretical Teaching

Considering that overseas students are very active in the class, they will interrupt the teacher at any time in the course of class, discuss with the teacher or ask for explanations. We take the initiative to reform the traditional teaching methods, pay attention to the interaction between teachers and students, adopt the "Interactive teaching method" to change the leading character of teaching from teachers to students, and adopt flexible and diverse teaching methods to improve the learning enthusiasm of students. This course is a highly practical course. In view of the cognitive level of overseas students, we applied the "Entity teaching method", teachers always show some common electrical components to the students in the class, help students to focus on the acquisition of relevant knowledge through perceptual recognition. In addition, common engineering circuits are often inserted in the theoretical explanation to stimulate students' interest in learning. For example, when talking about transistor amplifier circuit, the microphone and radio circuits are introduced in class. Furthermore, we introduce the "Project teaching method". As listed in the Table I, two different project are shown.

TABLE I. TEACHING CONTENT DESIGNS

Content of courses		Professional Skills Requirements
Project name	Task name	
1. Simulation Design, Fabrication and Debugging of Adjustable Dual Output DC Regulated Power Supply	1.1 Identification and Detection of Semiconductor Devices	1. Read circuit diagrams of electronic and electrical equipment
	1.2 Application of Rectifier and Filter Circuit	2. Identifying Common Electronic Components and Electrical Components
	1.3 Analysis of Basic Amplifier Circuit	3. Can use multimeter to detect and judge the quality of common electronic and electrical components
	1.4 Analysis and Detection of Reference Voltage Regulating Circuit	4. Detection of Polarity and Performance of Diode and Triode with Multimeter
	1.5 Manufacture and debugging of low power DC regulated power supply	5. Skilled in welding with electric soldering iron and other tools
	1.6 Improvement and Enhancement of Design Circuit	6. Ability to assemble electronic or electrical products according to circuit diagram or electrical schematic diagram
2. Simulation Design, Fabrication and Debugging of Low Frequency Power Amplifier	2.1 Cognition of Integrated Operational Amplifier	7. Familiar with the use of multimeter, signal source, regulated power supply and oscilloscope
	2.2 Design and fabrication of preamplifier circuit	8. Analysis, Search and Elimination of Common Faults in Electronic Circuits with Common Instruments
	2.3 Design and Manufacture of Power Amplifier Circuit	
	2.4 Application of Negative Feedback in Amplifier Circuit	
	2.5 Design and Fabrication of Low Frequency Power Amplifier	

B. Reform of the Time Arrangement

From the original teaching plan, the experiment of the course is often arranged after the end of the theoretical course, which is not conducive to the students' understanding and application of knowledge. In order to deepen students' understanding of the knowledge they have learned, experimental teaching and theoretical teaching are interlaced so that the theoretical knowledge they have learned can be embodied in the experiment. In addition, due to the limited experimental class hours, we use the method of previewing the experimental content in the theoretical class to link the experimental content with the theoretical content, so as to

facilitate students to deepen their understanding of knowledge. Moreover, they can know the experimental process in advance and improve the efficiency of the experiment.

C. Reform of Experimental Content

In order to improve the quality of teaching and achieve good teaching effect, the experimental content has been adjusted after repeated research and experimental verification, some experimental contents have been deleted and comprehensive and innovative experimental contents that can cultivate students' enthusiasm and comprehensive quality have been added. As shown in Fig. 1, the basic experiment of

common emit amplifier circuit is added to the experimental teaching contents, and the welded circuit board made by the students is shown in Fig. 2. Fig. 3 is another new experimental content, voice-controlled LED lights. Fig. 4 is the welded circuit board. Fig. 5 and Fig. 6 are heart-shaped LED twinkle lights. Overseas students show greater interest in real components and circuits than in theoretical courses. Through the familiarity of components, the welding of circuits and the operation of actual circuits, they can grasp the knowledge points more thoroughly and comprehensively.

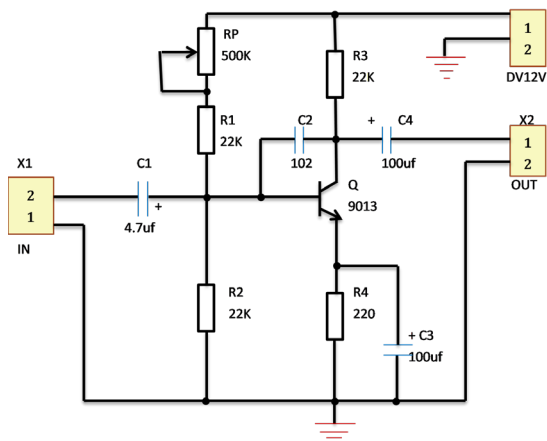


Fig. 1. Principal circuit of common emit amplifier

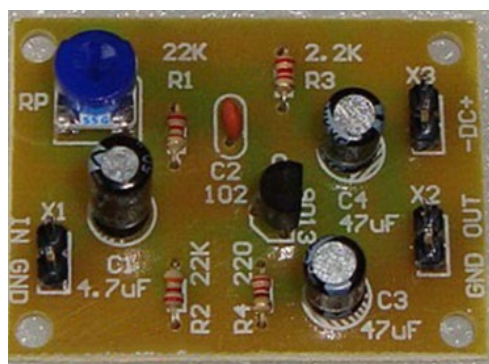


Fig. 2. Circuit board of common emit amplifier

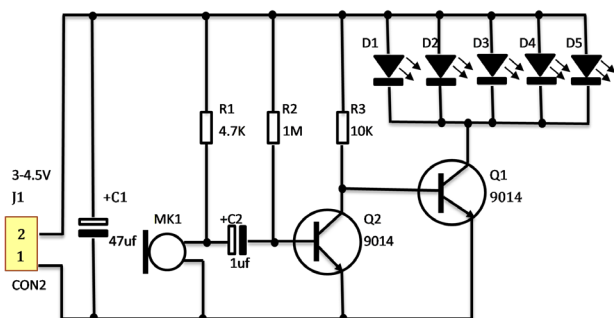


Fig. 3. Principal circuit of voice-controlled LED light



Fig. 4. Circuit of voice-controlled LED light

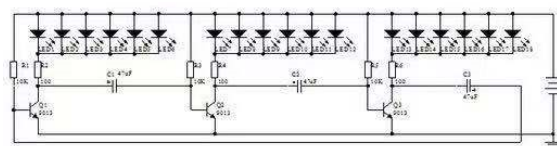


Fig. 5. Principal circuit of voice-controlled LED light

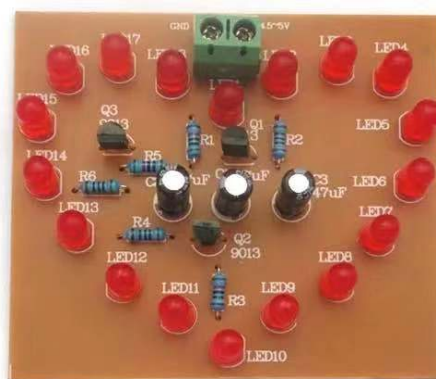


Fig. 6. Circuit board of voice-controlled LED light

D. Reform of Evaluation

According to the learning characteristics of overseas students, we applied new evaluation methods. The comprehensive course scores are composed of experimental grades, regular grades and final examination grades. The experimental grades accounted for 10% of the total score. Regular grades accounted for 40% of the total score, which consisted of 10% class attendance, 10% homework, 10% mid-term test and 10% final review test. Final examination grades accounted for 50% of the total score. Applying closed-book mid-term test and final review test can promote students' learning consciousness and independence, avoid weakening or formalization of learning, make teaching and learning tend to be optimized, and achieve the purpose of talents training.

IV. CONCLUSION

It is a challenge task to establish an all-round and multi-level international education system. Overseas students' education reflects the level of teaching development and

internationalization of a university. Through a series of reforms in the course and practical teaching of Analog Circuits course for overseas students, it not only stimulates their interest in learning, arouses their initiative, but also makes their mastery of knowledge more solid. As the development of overseas students education in Zhejiang University of Science and Technology is relatively recent, it faces many problems, such as the construction of supporting textbooks, the qualified teachers, experimental settings and so on. Therefore, in future teaching, every teacher should constantly improve their professional teaching level, explore and try more teaching methods, and improve the teaching quality of Analog Circuit course for overseas students.

Analog Circuit course is very popular with overseas students since we reform this course according to their characteristics. Through this course, they not only acquire a lot of knowledge about the working principle of devices and circuits, but also learn good methods and solutions to problems.

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