

Circuit Course Ideological and Political Construction Under the Background of New Engineering

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Abstract

Aiming at the problems of talent training innovation ability and lack of practical ability, the teaching content, methods and means of circuit teaching can be effectively researched. In the overall teaching design of circuit course, with the background of new engineering construction, STEAM education theory is integrated, and the integration point and carrier approach of ideological and political education are clearly defined, so that the organic and effective integration of curriculum ideological and political education and course content is carried out.

Keywords: Course Ideological and Political; Innovation ability; New engineering; Instructional Design

1. Introduction

Shenyang Jianzhu University adheres to the school philosophy of "rigorous research and the pursuit of excellence", and adheres to moral education and cultivating people. Fundamentally, the continuous deepening of various educational and teaching reforms is implemented .which is the one for the National Excellent Engineer Education and Training Plan and for The National Innovation and Entrepreneurship Training Plan for college students.

Circuit is a major core course for automation, electrical engineering and its automation, communication engineering, building electrical and intelligence, and is also the first course to enter the professional course learning stage. In the years of reform and practice of the curriculum team, adhering to the school's philosophy of "rigorous learning and the pursuit of excellence", the circuit curriculum has designed and optimized the knowledge, ability, quality and moral education training goals, and established the "trinity" curriculum goals of value shaping, ability training and knowledge imparts.

This course takes "moral cultivation" as the fundamental task, takes the teacher team as the leading, takes the student as the main body, and fills. By using teaching resources, the theory teaching system of circuit course is constructed from the discipline level, ideological education level as well as the characteristic ideological and political elements, in-depth exploration of ideological and political elements, internalization of curriculum ideological and political elements, ideological and political elements. Organic integration with the course content, forming a synergy effect, in the form of a subtle form of socialist core values, the ideological and political contents such as professional ethics in the circuit and electronic industry are integrated into the course teaching process to achieve value shaping and knowledge imparted.

2. Course objectives

Course objective 1: Training of engineering awareness and engineering knowledge application ability. The basic knowledge of applied mathematics, natural science and engineering science enables

students to master the concept of circuit, the characteristics of devices, the application occasions and the development trend, and understand the important position of this course in the field of automation engineering and its relevance to courses and professional fields such as information technology, intelligent manufacturing and automation.

Course objective 2: Ability development of circuit analysis: to make students familiar with the basic principles of circuit and master various circuit analysis methods. For complex engineering problems in intelligent manufacturing, building automation and other control fields, we can identify the key links of circuit parts of complex problems, cultivate students' comprehensive analysis ability and independent thinking ability, and lay a theoretical foundation for solving related complex engineering problems.

Course objective 3: Training of complex problem analysis and hands-on experiment ability. Through Thevenin theorem, RC first-order circuit response test, three-phase AC circuit voltage, current, power measurement and other experiments, students can master the basic experimental methods of circuits, cultivate students' ability to correctly collect data, test and analyze data, and analyze the measured data with the established mathematical model. The correct conclusion was obtained by comparison analysis and information synthesis.

Course objective 4: Apply engineering foundation and professional knowledge to circuit system design and development, and cultivate scientific research ability. According to the requirements of circuit system, master the principle and basic design method of complex circuit initially, choose the appropriate design scheme, and cultivate the basic ability of design and research problems of students are accomplished

Ideological and political teaching goal 1: Cultivate students' socialist core values, patriotic feelings and social responsibility. Through introducing the development and application of circuit technology in the field of automation, students can realize the development of the country and the technological advancement of the industry, and cultivate patriotic feelings.

Ideological and political teaching goal 2: Cultivate scientific thinking and engineering consciousness. Guide students to use simulation software for mathematical model simulation, inspire students to describe engineering problems with mathematical thinking mode, and cultivate students' scientific literacy, innovative thinking and concept of large-scale engineering.

Ideological and political teaching goal 3: enhance students' awareness of compliance with discipline and law. Start with the cultivation of safety awareness, cultivate students' awareness of rules and overall situation.

3. Overall Design of Curriculum Ideological and Political Construction

3.1. Build a "three-stage" curriculum and ideological and political teaching integration model

In the teaching organization of "Circuit" course, the three-stage whole process curriculum ideological and political integration model is adopted before class, during class and after class. Before class, teachers demonstrate a rigorous and serious teaching attitude with their understanding of the course objectives and careful preparation for the course. Pre-class task list is issued before class, and students preview by looking up information, using online resources to watch micro-classes, MOOCs, resource-sharing classes, etc. In the course of teaching by example, exploring spirit, home and country feelings and other entry points to stimulate students' innovative spirit of courage to explore and improve their ideological realm. After class, we use rigorous thinking, fair assessment, honesty in examination, unity and cooperation to achieve the

guidance of correct values. Before class, during class and after class, the three sections are integrated to realize the value shaping of students. In addition, the ideological and political integration design of the curriculum organically combines the teaching concept of "rigorous study and pursuit of excellence" of the school, and better interprets its essence.

3.2. Organic integration to explore new materials and mechanisms of ideological and political education

Combining with the practice of professional talent training and focusing on the ideological and political elements of the curriculum, the teaching resources integrating professional knowledge and ideological and political content are constructed. The integration of ideological and political elements and professional knowledge is designed according to specific knowledge points, and the course content system is fully integrated and designed, providing solid support for the effectiveness of the teaching process. The main ideological and political resources of Circuit course are shown in Table 1.

3.3. Seamless connection and practice of the new form of education model of "integration of science and reality"

The integration mode of theory and practice makes the teaching effect of theory and experiment courses $1+1>2$. The introduction of multi-simulation software provides a good practical environment for the teaching of "Circuit" course, makes the theory and practice seamlessly connect, and improves the practical teaching effect. Combined with the course content, students can complete the design and implementation of the project through "intra-group cooperation and inter-group competition". Through the teaching idea of raising questions, exploring problems and solving problems, the students are trained to use knowledge and think actively. Through hands-on practice, students have been able to cultivate practical ability and innovative consciousness.

3.4. Take multiple measures to reflect students' creativity, collaboration and personalized classroom teaching design

In the classroom teaching, many methods such as case teaching, task-driven teaching and special report teaching are flexibly used to make the classroom truly "alive". The use of case teaching is to introduce cases, current affairs and hot topics that students are interested in for course teaching organization, design and case analysis; Task-driven teaching is to design the teaching situation, establish the appropriate mathematical model, implement it with various circuit structures, compare the advantages and disadvantages, determine the appropriate scheme, and implement it, and write the design report. The whole process can train students' strict scientific thinking, normative consciousness, quality consciousness and teamwork consciousness, and improve creativity; Special report teaching is to carry out special report activities for the ideological and political content of some courses, and students can independently consult information, make PPT and make special reports, such as "the development prospect of circuit theory", "Where is China's chip road", "Visio drawing and use ", "Calculator complex operation", etc., which not only completes the personalized training of students, but also can play a "polishing. The effect of "silent" ideological and political education.

Table 1 Main ideological and political resources of Circuit course

Teaching content	Course ideological and political resources	Course ideological and political education goal
History of the development of modern circuit theory	1. There is no Chinese name, which is also the main reason why China is backward in the field of integrated circuit technology and is "stuck" by foreign countries. 2. In the early stage of the outbreak, consumable digital electronic products such as infrared thermometers, CT machines and other medical equipment were in short supply, and product optimization was urgently needed; For high-end equipment relying on the import of complete machines, it is more necessary to break technical barriers through scientific and technological innovation to achieve independent supply.	1. Establish crisis awareness; 2. The importance of independent innovation 3. Firm determination to work hard for the great rejuvenation of the Chinese nation.
Lumped parameter circuit	1. The lumped parameter model is used to replace the distributed parameter model in the actual circuit, usually in order to simplify the circuit and catch the main contradiction. Starting with practical problems, the significance and complexity of distributed parameter model are explained, and various secondary contradictions are ignored. 2. The lumped parameter circuit analysis must follow two types of constraints to social life is also the same, without rules, no radius, should abide by social ethics and corresponding laws and regulations.	1. Set up philosophical thoughts, treat things to grasp the primary contradiction and ignore the secondary contradiction. 2. Be a role model in abiding by social ethics and laws and regulations.
Circuit and circuit model	Put forward the design and production scheme of "solar energy" power car, allowing students to complete the production of simple solar energy power car by means of intra-group cooperation and inter-group competition.	1. Develop the sense of cooperation and practical ability; 2. Love science and innovation.
Circuit graph	Combined with Konigsberg seven Bridges problem, the circuit diagram guides students to use mathematical thinking to describe and solve engineering problems.	Cultivate students' engineering consciousness to solve engineering problems.
Circuit current method	Node voltage method and branch current method can calculate the current or voltage of a branch, and many circuit analysis methods can solve practical problems.	Guide students down-to-earth learning, open up ideas, accumulate steadily.
The mesh current method	Explain the charm of conjecture and hypothesis in scientific inquiry from the theory of continental drift, and extends to the hypothesis of mesh current and loop current, so that students can feel the important scientific research method of conjecture and hypothesis.	Cultivate students' ability of logical thinking and dialectical thinking, and form scientific world outlook and methodology.
Equivalence Circuit	For the abstract problem of "external equivalence", the equivalent circuit fully mobilizes students' thinking and enables them to see the essence through the phenomenon.	Further deepen the understanding of knowledge, and exercise students' ability to find problems, analyze problems and solve problems.
The superposition theorem	The superposition theorem guides students to compare the superposition of forces, "unity is power", which not only makes the superposition theorem of linear circuits easy to understand, but also makes students understand that the collective is composed of individuals. Especially in the process of epidemic prevention and control, the relationship between the part and the whole, the individual and the country encourages students to superimpose their personal struggle and dedication into the development and growth of the country.	Only by giving full play to the strength of each individual can the collective grow and develop.
Capacitance	1. Explore the working principle of capacitive touch screen through experiments; 2. The unit of capacitance is named after physicist Faraday. Faraday was born poor, primary school only two years, but finally became a great scientist.	1. Encourage students to carry out independent, exploratory and cooperative learning based on resources; 2. Cultivate students' character of perseverance and perseverance.

The phasor method	Introduce the deeds of scientists, the life of the author of the phasor method, Steinmetz, who was born with disabilities and eventually became a great scientist. Encourage students to be fearless of difficulties and firm faith;	Guide students to be down-to-earth, willing to sit on the bench, devote themselves to research, and contribute to the development of science and technology
Maximum power transmission theorem	1. Through the knowledge transfer between the maximum power transmission theorem of DC circuit and the maximum power transmission theorem of AC circuit, the learned knowledge system can be connected before and after and three-dimensional correlation. 2. Use the knowledge to solve practical problems, so that students understand that "practice is the only standard for testing truth". 3. According to the problem of different transmission power requirements for different efficiency, the concept of energy saving and emission reduction is introduced, the maximum efficiency of the product is played, and the retention of "green water and green mountains" is "Jinshan and silver mountains".	1. Cultivate students' scientific thinking habits of comparative research and drawing inferences from one another to improve students' scientific literacy. 2. After learning theoretical knowledge, it must be practiced and applied. 3. Respond to the call of the state and contribute to energy conservation and emission reduction.
Power factor	Understand the relationship between power factor and energy utilization efficiency, understand the harm of too low power factor.	Cultivate professionalism and social responsibility.
Three-phase circuit	China's UHV technology has always been in the forefront of the world's thematic cases, demonstrated by video, and launched a thematic discussion. In the course of teaching symmetrical three-phase circuits, by demonstrating the pursuit of "symmetrical beauty" in Chinese architecture, Chinese people's sense of order in heaven and earth as well as their pursuit of perfect harmony and world peace are introduced.	Inspire students with national pride.
Sinusoidal steady-state circuit analysis	Comparing sinusoidal steady-state circuit with direct current circuit, summarizing similarities and differences and	guiding students to view dialectical unity correctly.
Resonant circuit	1. Through Chang 'e 5, China's Sky Eye, Hong Kong-Zhuhai-Macao Bridge and other advanced technologies to focus on the relationship between individuals and the country, guide students to resonate with the motherland. 2. Introduce characteristic alumni culture, that is, Yao Qiming, the first Chinese track design alumnus, via video connection.	1. Enhance students' national pride and self-confidence. 2. Model education affects students' value orientation, code of conduct, entrepreneurial consciousness and gratitude. Circuit experiment
Circuit experiment	1. Pay attention to check the operation process of power supply, startup and shutdown before the circuit power test; 2. Carefully connect the line, correctly use the measuring instrument, obtain the experimental results, orderly place the tools, and maintain the environmental health of the station 3. Electronic products must produce a large amount of electronic waste. In the students' experiments, the use of wires, various electronic devices and the design process should be minimized. 4. Guide students to fear life, rules and duties through fault analysis.	1. Let students always keep in mind the safety of electricity use, and implant the habits of safe electricity use and standardized operation into students' hearts. 2. During the experiment, the process of learning unity of thought, unity of knowledge and action, the formation of professional ethics and professional quality, is also the concrete embodiment of students' cultivation of self-striving craftsman spirit. 3. Cultivate students' awareness of economy and environmental protection. 4. Safety first, life first

4. Curriculum Construction and Application

4.1. Course construction and development process

Since the course was opened in 1979, the teaching system of circuit course has been built with teachers as the leading team and students as the main body, making full use of teaching resources. In 2010, the circuit course was rated as school-level excellent course, in 2012, the circuit bilingual course was launched, in 2020, the circuit was the first first-class undergraduate course in Liaoning Province, in 2021, the circuit was approved as the school curriculum ideological and political project, in 2023, the circuit was approved as an online learning cross-school credit course. In 2023, the circuit was recommended by the school to participate in the ideological and political demonstration course selection of Liaoning Province general higher education courses.

4.2. Key problems to be solved in curriculum and teaching reform

To change the teaching methods that teachers are accustomed to, that is, the mentality of "bystanders" of students' learning, only "teaching", regardless of "learning", and lack the ability to cultivate students' "living learning, thinking, practicing and expressing" (learning, thinking and acting table);

To change the teacher as the main body, the examination paper based evaluation method, only "examination", regardless of "evaluation", the lack of teacher's process feedback and students' ability to advance and establish the process of the organic combination;

To change the theoretical and experimental courses of their own, loose connection status. Through comprehensive, innovative and simulation experiment projects, big innovation projects and competitions, the new form of education model of "integration of truth and imitation" is adopted to solve the problem of disconnection between students' theory and practice.

4.3. Construction and application of course content and resources

Update and enrich the teaching content, introduce ideological and political elements, the latest scientific research results, and comprehensively improve the comprehensive strength of students. According to the practice of professional personnel training, the teaching resources that integrate professional knowledge with ideological and political content are constructed. Keeping up with the international frontier of science and technology to achieve the teaching content with The Times, the course introduced the latest research report of Professor Wei Shaojun, an expert in the field of integrated circuits of Tsinghua University, on the future chip technology, to guide students to learn professional knowledge and skills, and cultivate students' feelings of serving the motherland and the spirit of showing science. Combined with the scientific research project "PCB Solder Joint Inspection Research based on Rough set Theory ", students can understand the printed circuit board (PCB) inspection process, and expand the depth and breadth of learning.

Reform teaching methods, practical task-driven teaching, multi-simulation software-based case teaching, flipped classroom and other diversified teaching models. Using task-driven teaching, taking real enterprise projects as topics, students work together to complete tasks, improving students' collaborative awareness, ability to analyze and solve problems. Multisim software is used to simulate the circuit and practice the teaching of "integration of theory and reality". The flipped classroom is carried out, and students can consult information independently and make special reports, such as "Where is China's chip road" and "the drawing and use of Visio", which not only completes the personalized training of students, but also plays the ideological and political education effect of "wetting things quietly".

The development and utilization of modern multimedia technology has promoted the improvement of teaching quality. Actively adopt multimedia video technology, electronic teaching plans, CAI courseware and other teaching AIDS to carry out intelligent teaching practice. The curriculum (ideological and political) resource library has been established, including 32 teaching task sheets, 21 teaching courseware (PPT), 1 electronic teaching plan, 8 problem banks (950 exercises), GIF, 28 micro-lessons, 3 circuit teaching software, exam outline and 26 website links. During the epidemic period, mixed online and offline teaching has been adopted to comprehensively improve the "rain class" courseware. 100% of the students participated in the auxiliary teaching of the rain class, interactive 67 times in the way of "submission", 2545 times in the way of "bullet screen", 2366 times in the way of "roll call, do not understand, red envelope".

The construction and improvement of course network has set up a platform for students to learn independently. Realize the course resources and video online, provide links to websites closely related to the subject at home and abroad, and build a three-dimensional teaching resource library. The download rate of teaching resources exceeds 85%. Teaching calendar, syllabus, electronic teaching plans, PPT and other materials are complete and shared online. Open online Q&A and discussion area, interact with student discussion area, and answer more than 200 questions/semester.

4.4. Teaching content and implementation of the course

Teaching reform and practical activities should be carried out according to the teaching content of the course. Design teaching tasks, organize activities and guide participation from the two main lines of teaching and learning, focusing on cultivating students' ability of learning, thinking, acting and presentation (living learning, thinking, practicing and expressing).

The cultivation of learning ability: the construction of knowledge ecology, such as circuits and high numbers, signals and systems, analog electronics, reflects the relationship between disciplines, new knowledge and old knowledge both influence and harmonize each other. Build knowledge levels and build structured thinking, such as mind mapping. Focus on the vitality of knowledge, carry out brainstorming, and predict the development of cutting-edge circuit technology in the next 5-10 years.

The training of critical thinking ability of learning, thinking and action table: to drive the task, so that students can deepen their understanding of the knowledge in the actual task. The implementation is completed by grouping, group discussion and collaboration. Students analyze and calculate the circuit by consulting reference books and manuals, and group summaries and reports. Cultivate students' normative consciousness, problem-solving ability and teamwork consciousness.

Practice ability training: Starting from the content that students are most familiar with, starting from the actual engineering application needs, using the form of "task (problem) leads to knowledge point", the task is thrown to students in advance, such as looking at the socket at home, and studying the two-hole, three-hole socket and four-hole socket are several phases of electricity? What is the relationship between the socket and the "fire line" and the "middle line" that the construction master often says? The relationship between three-phase circuit and single-phase circuit is extracted from the electrical equipment in daily life. To assign practical tasks, students need to learn from theory, design plans, organize discussions, and complete practical practice. Students' practical innovation ability is constantly improved in this process.

Training of expression ability of learning, thinking and action tables: It is realized through flipped classroom, focusing on the extension and expansion of teaching content, guiding students to take the initiative to express and show, and students to look up materials, make PPT and make special reports.

5. Evaluation method and mechanism construction

From the perspective of post competence, the multi-dimensional teaching quality evaluation system of "curriculum ideology and politics" is constructed from the evaluation subject, evaluation link and evaluation content.

Table 2 Evaluation method and mechanism construction

Evaluation type	Evaluation node	Evaluation link	Evaluation content	Evaluation subject	weight (%)
The process	Before class	Online test	Preparation achieved degree	teacher	5%
	In class	Performance	Concentration, interactive	teacher , students	5%
		Special report	Materials, ppt production, collaboration, achievement	teacher , students	
		Stage test stage	Stage knowledge mastery achievement degree	teacher	5%
	After class	Homework and discussion	The completion of after class and quality	teacher , students	5%
		Mind map	Knowledge organizer	teacher	
		Experiment (hardware + simulation)	Experiment completion, experiment related data analysis	experiment teacher	10%
finality	The final exam	Theoretical knowledge	Achievement degree	teacher	70%

6. Effect of curriculum ideological and political teaching reform

After several rounds of curriculum ideological and political reform, through classroom teaching feedback and relevant data analysis, students are active in class, which can stimulate students to generate internal learning motivation, effectively promote students' understanding, mastery, expansion and deepening of curriculum knowledge, increase students' interest in learning, and greatly improve their scores. According to the follow-up survey of teachers of specialized courses conducted after the curriculum reform, students are interested in learning specialized courses, have an increasing sense of professional identity, can quickly enter the state of learning, and take the initiative to participate in curriculum practice. The number of students participating in electronic competitions is increasing, and the award level is also showing an increasing trend. In the process of finding and solving problems, students exercise their dialectical and unified scientific thinking, stimulate the innovative spirit of exploration, and enhance their confidence in solving complex engineering problems with a rigorous and serious learning attitude.

The teaching design of Circuit, which integrates ideological and political elements, provides a model for other courses. "Science and technology for the country", "craftsman spirit", "professional quality" and other teaching methods throughout the whole process of teaching, using cases, project-driven and flipped classroom teaching methods, so that students participate in the course, understand the importance of the

course and the power of science and technology, in a subtle way to develop rigorous and excellence in scientific attitude.

Under the guidance of the ideological and political concepts of the curriculum, students' ability and accomplishment have been significantly improved. According to the specialty and curriculum characteristics, students actively participate in discipline competitions to improve practical ability. In recent years, students have won 11 national awards and 40 provincial awards in various innovation and entrepreneurship competitions at all levels. Among them, 5 projects involving cross-disciplinary and cross-professional students won awards, effectively driving the enthusiasm of students from other related majors to participate in the competition and the sense of mission of scientific and technological innovation.

7. Conclusion

Combined with the characteristics of our school and the orientation of talent training, the knowledge, ability and commitment of the course team to "Circuit" Quality and moral education training objectives are deeply discussed, and the "trinity" curriculum objectives of value shaping, ability training and knowledge imparting are established. Combined with the teaching content of the course, the integration points and carrier ways of ideological and political education are made clear, so that the organic and effective integration of curriculum ideological and political education and course content is carried out.

Curriculum ideology and politics according to the continuous construction plan, according to the "three characteristics and one degree" comprehensive evaluation, reflect the students' mastery of the curriculum from multiple subjects, increase the degree of participation in the evaluation, add the role of counselors in the curriculum ideology and politics, and further establish a sound assessment system. At the same time, through questionnaire survey to understand the students' feedback on the course teaching, combined with the supervision experts, school leaders and peer teachers' listening opinions, appropriate adjustment of the course ideological and political teaching methods, content and integration points, in order to better complete the ideological and political teaching objectives.

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