Design and implementation of practical teaching of Programmable Devices and Applications

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Abstract: The practical teaching of "Programmable devices and Applications" course is a concentrated practice link with the curriculum theory teaching. This paper mainly from the teaching objectives and content design, teaching implementation and curriculum thinking and politics, curriculum assessment and continuous improvement of three aspects of practical teaching process design and implementation. By optimizing the course objectives and contents of practice teaching and continuous improvement of teaching, we can achieve the graduation requirements of the course and finally realize the cultivation of students' ability.

Key words: practice teaching; Teaching design and implementation; Teaching effect

Introduction

The development of modern electronic technology and micro-electronic technology has highlighted the importance of programmable technology in the fields of electronics and communication, image processing and computer applications. "Programmable Devices and Applications" is a required professional course for electronic information engineering majors. Experiment and course design are the concentrated practical teaching links of this course. The main content of the experiment project is to use the hardware description language VHDL language for design, learn to use EDA software development tools for compilation and simulation, use the experimental development system for design, download and hardware testing, practice the basic knowledge and specific application of digital electronic system design.

With the OBE teaching concept of "student-centered, outcome-oriented and continuous improvement", the university education is promoted to carry out comprehensive teaching reform, continuously update the teaching concept, reform the talent training system, and establish a talent training model suitable for engineering certification. By exploring the design and implementation of practical teaching, students can deepen their understanding of knowledge points in theoretical courses, improve their ability to solve practical problems, improve their ability to use advanced simulation tools to design and analyze complex engineering problems, and cultivate their ability to effectively use resources to understand the latest technology in EDA related fields and consult references. The ability to write reports and other technical documents. Through the initial comprehensive training, students are trained to have innovative ability and establish a scientific view of linking theory with practice. In the professional personnel training system, it plays the role of "cultivating quality and improving ability" for students, and achieves the graduation requirements in the training program.

1. Teaching objectives and content design

1. Teaching objectives

Practice teaching guides students to learn to use hardware description language for digital module programming, function simulation and hardware testing, and can use electronic technology and EDA technology to complete the design of electronic system. Make students deepen the understanding of "programmable devices and applications" course content, cultivate students' ability to combine theory with practice and eliminate simple faults, and cultivate students' engineering thinking and innovation consciousness. The specific teaching objectives are as follows:

(1) Knowledge objectives. Learn to use hardware description language VHDL module programming; Learn to collect, consult the literature, to determine the program; Apply software development tools to electronic system design, simulation and hardware testing.

(2) Capability objectives. Can be more comprehensive circuit function division; Can use the experimental development system for hardware circuit testing; Will write reports, statements, system summary. Have the ability to use EDA technology and electronic technology theory to solve practical engineering problems.

(3) quality goal. With engineering thinking and innovation consciousness, able to combine theory with practice to solve system engineering projects. With a sense of lifelong learning and a sense of responsibility towards learning and tasks.

2. Instructional design

The main content of the experiment is to learn to use the hardware description language VHDL language for electronic system programming design, learn to use software development tools for compilation and simulation, and use the experimental development system for program design, download and circuit testing. The practical content is divided into six links: study and research, program design, program design, system design, simulation test and experimental summary. Take digital clock experiment teaching as an example, as follows.

(1) Study and research. Learn the basic methods of clock BCD code counting, understand the difference between base 60 and base 24 BCD code counting and binary counting, and master the different processing methods of the two counting aspects.

(2) Scheme design. According to the design requirements of the digital clock in the experimental instructions, determine the overall module composition of the system, divide the digital clock system into functional modules such as time-minute-second counting, frequency

division, seven-segment display decoding, hourly signal, digital tube position selection, etc. Define the ports of each module, and pay attention to the matching of the ports of the front and back modules.

(3) Module design. Under the guidance of the teacher, the hierarchical design idea is applied. First, the experimental tasks are divided into several, and the students are grouped to complete the design and debugging of one of the modules. Then, the modules are mapped and connected by the component example statement or schematic input method, and the experimental tasks are finally completed. Through the experiment process to cultivate the spirit of cooperation between students, while deepening the concept of hierarchical design.

(4) System design. Through the experimental process to further understand the deep meaning of the system project design process, understand the project management and the top-level design of the unit module connection concept.

(5) Simulation test. After the program design, compilation and debugging, function simulation is completed, observe the simulation waveform of each module, analyze the simulation results, and verify whether the function of the module is correct; Finally, according to the experimental box provided by the laboratory, the wiring and download test are carried out, and the test acceptance is carried out.

(6) Experimental summary. After the end of the field experiment, the same team members conducted discussion and analysis to understand the experimental results of different experimental methods, system delay and chip resource utilization, accumulated practical experience, and wrote the experiment report.

In the process of experiment, students are required to carry out top-level design, module design, experiment report and other links in accordance with the requirements and specifications; The attention points of the design process, such as the composition and parameter requirements between the system and the module, the warning information in the compilation process of debugging, the system error of the test process, etc., need to be analyzed.

2. Teaching implementation and curriculum thinking and politics

1. Teaching implementation

Experiment is a relatively complete engineering practice project, in the experimental teaching, according to the teaching design from the following aspects of teaching implementation, to guide the students, the specific implementation process is as follows.

(1) Citation. The experiment instructor arranges the experiment tasks, guides the students to preview the self-study, and reviews the previous experiment content.

(2) Study. According to the requirements of experimental design, self-study, design the overall scheme, divide the design system into several modules according to functions, and write the preview report.

(3) Practice. Experiment site students according to the task to write each module VHDL source program, and on the computer debugging, simulation by recording the simulation results of each module. The top level design of the system, pin locking, debugging, simulation and download the experiment box test.

(4) Supervisor. Experiment on-site teachers guide students throughout the whole process, and strictly record attendance and experiment conditions.

(5) Analysis. Students group discussion, the system error in the process of the experiment, delay and other problems are analyzed and summarized.

(6) Change. The teacher will correct the experiment report, add the achievement of experiment teaching and put forward suggestions for continuous improvement when analyzing the degree of achievement of curriculum objectives.

The on-site teachers guide the students throughout the experiment, and strictly record the attendance and experiment situation. Judging from the effect of teaching links such as preview, experiment process, experiment report and group discussion analysis, most students can complete the teaching tasks according to the requirements in all links. The whole experiment teaching is carried out by EDA technology, and the experiment content is close to life, with practicability, comprehensiveness and engineering. Taking digital clock as an example, the teaching process combines electronic technology, EDA technology and other related knowledge, and uses the concept of hierarchical design to cultivate the spirit of mutual cooperation and team cooperation among students. In the process of module design, the functions such as counting system and time on the hour can be designed by themselves, which can improve students' ability of independent thinking and innovative problem solving, and reflect the high order of design.

2. Curriculum ideology and politics

According to the ideological and political requirements of higher education courses, engineering courses should guide students to support the national scientific development strategy, cultivate students' spirit of excellence, bravely carry out the mission of national rejuvenation and enhance their international vision. Among them, practical teaching should meet the requirements of specific disciplines as well as ideological and political courses. The main elements of ideological and political course excavated in practice are as follows:

(1) Stimulate students' enthusiasm for learning through the history of EDA technology and chip development. At the same time, the implementation of teaching content and the training of scientific spirit will be combined in the experiment to improve students' ability to analyze and solve engineering problems.

(2) The key technologies of integrated circuit chip design mainly rely on imports, the chip design and manufacturing encountered difficulties, and the chip supply of American companies, and the photolithography machine of Dutch ASML company, etc., inspired students to have national feelings and the responsibility of national rejuvenation.

(3) Through the group design and discussion of students in practical teaching, the spirit of teamwork, innovation and entrepreneurship

of students is cultivated, and the behavior and ideal pursuit of students are reasonably guided, so as to achieve the effect of practical education.

3. Curriculum assessment and continuous improvement

1. Assessment standards

The assessment standard is based on the students' familiarity with the experimental content, the reasonableness of the module division, the resource utilization rate of the module design and the completion of the top-level circuit, the format and quality of the experimental report, the situation of answering questions and the learning attitude, etc. The experimental results are evaluated according to the five levels of "excellent, good, medium, pass and fail". The experimental process (including hands-on operation 30%, group discussion 10%, team cooperation 10%) accounted for 50% of the experimental score, and the experimental report (including preview report 10%, data accuracy 20%, content standardization 20%) accounted for 50% of the experimental score.

2. Continuous improvement

In the future, we will continue to update the experimental content and appropriately add some new engineering application design cases related to programmable technology. In terms of content selection, we can ensure the completion of the experimental content stipulated in the syllabus, and at the same time improve students' interest in learning the course. In the selection of methods, the teaching method of introducing engineering projects will be adopted to create more opportunities for students to participate in small projects and teaching interaction, so that students can effectively solve the problems in the design and improve their practical and innovative ability. According to the needs of the independent search of information, determine the design plan and other processes also enable students to establish the concept of mutual cooperation and team cooperation.

Practice can also add some open projects, give the relevant design indicators and logical functions of the digital system, students according to the learned knowledge of their own program design, module programming and simulation test verification. Usually actively promote students to participate in various electronic design competitions, improve hands-on ability, let students combine theoretical knowledge with engineering design, improve students' practical ability of electronic design and project research and development ability, and strengthen the cultivation of interest in programmable technology and ability.

Epilogue

This paper takes the practical teaching of "Programmable Devices and Applications" course of electronic information engineering major as an example, adhering to the educational concept of OBE, comprehensively using EDA development software to carry out the reform research of curriculum practice teaching, with three teaching characteristics: insisting on "learning as the center", highlighting engineering thinking, and integrating curriculum ideology and politics. From the perspective of teaching effect, the design and implementation of project course teaching stimulates students' thirst for knowledge and drives students' enthusiasm. The teaching reform practice of this course can train students to have the knowledge, ability and quality to solve the problems in the fields of signal and intelligent information processing, which has good practical significance, and has good demonstration and application value for the teaching of related professional courses.

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