

Teaching reform on course "signals and systems"

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Abstract—Form the requirements and teaching process of course "Signals and Systems" to explore the course contents selection and course arrangement of "Signals and Systems ". From the characteristics of the 90 students and the status of teaching to analysis problems in "Signals and Systems" course teaching, and some personal opinions and recommendations are expressed in the paper, that in order to achieve " signals and Systems "course teaching quality rising in our university.

Keywords—Signals and Systems; Curriculum; Teaching Quality; Teaching Reform

I. INTRODUCTION

Almost all of the engineering, technique and research fields were related to the problem of signals and systems, so "Signals and Systems" course is a basic professional course for the profession of electric Information in the university, and it is also an entrance examination courses for related postgraduate profession. With the rapid development of information technology, concepts and analysis methods of signal & system have been introduced into various information related fields. It is increasingly becoming engineering and professional technical basis for the electronics, information technology, communications, automatic technology, computer science, signal processing, radar system, measuring systems and etc. The course plays a connecting role; its importance can not be replaced by any other courses in the teaching curriculum system.

"Signals and Systems" course is e strong in theory and technical aspect. It reflects the nature of things, and is a combination of the physical nature, mathematical concepts and engineering, in college engineering curriculum system plays a connecting role. The teaching purposes and tasks of this course is to train students' basic system concepts and the ability to analyze issues, to grasp commonly used analysis methods for signals and systems, and to lay the necessary theoretical basis for the further follow-up course study, like digital signal processing, communication electronic circuits, communication theory and automatic control theory. Course content had closely linked to the curriculum system; it plays a decisive impact to establishment and implementation of the electric Information curriculum system for undergraduate students. Therefore, teaching reform for "Signals and Systems" course is particularly important.

Since 2011, the large category enrollment was put into practice in our college, and "Signals and Systems" course

was became the professional basic courses for all students in the college. The course has 54 hours of theoretical teaching time, and 20 hours of experimental time. Now the teaching reform of the course has begun, and strives to enable students to gain more professional knowledge through the reform. In this paper, the author has proposed some of the works and thinking in the teaching reform of the "Signals and Systems" course.

II. THE BASIC STATE OF THE COURSE

"Signals and Systems" course features on strong theoretical knowledge points, a wide coverage of technical fields, and requiring students to have comprehensive knowledge of mathematics. While teaching the course we should pay attention to the links and differences of the pre-course like "Circuit Analysis". To course "Circuit Analysis", this course is more abstract and more general. The basic theories and analytical methods were studied from the view of circuit point in course "Circuit Analysis", but from the view of the system point in this course. Therefore, the basis of "Circuit Analysis" focused on solving the branch currents and node voltages of the circuit, and this course focus on solving output response that according to the characteristics of the system and the input signal .

The task of course "Signals and Systems" is to enable students to get the basic theory, basic knowledge and basic skills of the signals and systems analysis, to train students to analyze and solve engineering problems, to lay a good foundation for professional courses study and professional work. The main problem to be resolved in teaching process is as follows:

From the point of arranging the teaching time and teaching content, there is the contradiction of the huge teaching content and less teaching hours, so the students can only rely on doing exercises to consolidate and understand the course content. From the overall considering, if we lack of inter-related courses considering, it is unfavorable on developing students' abilities and qualities.

From the characteristics of the course itself, the course needs the application of mathematical tools and it is abstract in content, so the students will find boring in course studying, which results in the mood of weariness. How to link the abstract mathematics with physical concepts and practical applications are the important issues to be addressed in the course teaching.

From the point of teaching means and methods, the traditional teaching methods lacks the intuitive visualization

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for signal analysis results in the course, students have to take a lot of energy and time for a complicated math calculation, but not really understand the practical meaning of signal processing.

From the view of practice, the traditional teaching methods lack of actual hands-on experience for the students. But the course has a strong content on the application, design, debug and analysis, so the students can not apply what they have learned.

Some students' learning purpose is not clear. The course studying not only to problem solving and to master problem-solving skills, but also to understand their intrinsic links, to examine the issue acumen, and so to apply their knowledge. As teachers need to explain the scientific nature of the content correctly and disseminate the knowledge properly

It can be seen from the above aspects, the traditional teaching methods and means for "Signals and Systems" course had been seriously affected and restricted students' interest in learning and had also been seriously affected teaching effectiveness. And neglect on the practical aspects will only make the students lacking of imagination, so it can not be achieved the harmony on understanding, visualization and being practice oriented. Therefore the traditional teaching methods and means would greatly reduce the quality of teaching.

III. "SIGNALS AND SYSTEMS" COURSE REFORM METHODS AND MEASURES RECOMMENDED

We can see from the basic state of course "Signals and Systems", teaching reform is urgently needed in order to increase students' learning interest and ability. Our approach and ideas are as follows:

A. *construct a reasonable course system*

The characteristics of this course are more theoretical, more content, especially in the case of teaching hours compression, the contradiction between teaching content and teaching hours become more prominent. So it is necessarily to construct a reasonable course system

To construct a reasonable course system, it is necessary to develop a reasonable syllabus. With streamline, integrate, and add timely content, the teaching program can be constructed "realized". It is need to reasonable arrange the teaching content and experimental content, and focus on improving students' learning ability. Course content selection and organization, not only need to consider the comprehensive, systematic, and efficiently to impart knowledge to students, but also to help students build knowledge systems.

B. *Select the appropriate textbooks and teaching reference*

Various aspects of teaching, the selection of teaching materials is extremely important. Not only is it a textbook for teaching, is also the basis for students to preview and review. There are lots of books on "Signals and Systems" or signal analysis and processing. From the training objectives, we need to consider the link between the level of knowledge

before and after the course. A reasonable choice should be argument rigorous, logical and strong on the inspiring. In addition to select the appropriate materials, we should also recommend characteristics teaching reference materials to the students.

A good textbook should have following features: content depth is moderate, depiction is coherent clear, structure is reasonable, and theoretical analysis is thorough. The contents of "Signals and Systems" are huge, there are time domain analysis and frequency domain analysis, continuous-time signal analysis and discrete-time signal analysis, and also application on the basis of the knowledge. The textbook should be able to inclusive and give students the most comprehensive knowledge, the most clearly structured. At the same time, we must be based on the actual situation of our students, curriculum system to select a textbook with moderate depth in content, clarity and reasonable, structural arrangements best suited to us. After full consideration, we have selected a textbook that published by Xi'an University of Electronic Science and Technology Publishing House, editor in chief by Mr Chen Shen-tan, and "Signals and Systems" that editor in chief by Alan V Oppenheim as a reference textbook. In the textbook, the content is arranged in parallel to establish the analysis method of continuous time and discrete-time, it can take advantage of the common ground between the continuous and discrete time to share their rational and emotional knowledge, and the differences between the two domains can be used to deepen the understanding of the analysis method, while helping to reduce the number of teaching hours, guide students to mastery and explore at the same time. The organization of the textbook allows reader to achieve a multiplier effect.

C. *The improvement of teaching methods*

"Signals and Systems" is an important basic course, it involves in some content of abstract and microscopic description. The traditional teaching way is not easy and intuitive for students to understand and accept the basic content. This can be done through multimedia courseware. Through the intuitive image or animation displayed, we can give students a visual image; deepen understanding of the issues for some difficult understanding problem. Specific practices areas follows: (1) for difficult understanding content, it provided by the teaching materials are often not intuitive and vivid, we can make use of Matlab, such as in continuous system process, for the visual expression of the change process, we use powerful visualization capabilities provided by Matlab to assist in the understanding of output waveform. So the abstract theory in the classroom can be vivid visual display. (2) for courseware, it is assembled by electronic teaching plan, FLASH animation, and Matlab GUI interactive animation. The electronic teaching plans were produced by PowerPoint. It covers main content and basic requirements of course. Teachers can organize and modify flexible according to the needs of classroom teaching. The animation can be divided into the basic concepts and operations according to the manifestations to explain the extension of teaching content and teaching cases.

D. Play the role of experiments on understanding the course content

"Signals and Systems" is a course that needs to closely integrate with the experiments. The response of the signal and signal generated by the system can be more intuitive awareness and understanding through experimental results. It is of great help and inspiration for student learning theoretical knowledge. In addition, through lab experiment can develop inspired thinking, observe, analyze and problem-solving abilities of students. Therefore, we specially designed course of 20 hours for signals and systems experiment. By experiments students can familiarize with the use of the experimental equipment and software, to complete the basic skills training. Then let the students to design signal processing and information systems independently according to what learned in the textbook or teaching classes. The experiments of this design will enhance students' interest of learning. MATLAB is a internationally recognized outstanding simulation software, it can assist students by means of numerical calculation, visual modeling and simulation debugging to understand and grasp the theoretical course content of signals and systems courses.

IV. CONCLUSIONS

The teaching process is the process of interaction between teachers and students; the purpose of teaching is to enable students to master knowledge, empowerment through teaching. Some personal ideas on teaching reform for course "Signals and Systems" were described in the paper. The course involves a wide range of the subject areas, its theory and practice is developed rapidly, its analytical methods are constantly updated and ever-expanding. So the course teaching reform can not be completed on one step. Gradual modification in practical teaching and improve the teaching process should continue to carry on. To acquire new knowledge, to adopt new teaching methods and educational philosophy, dynamic reform the teaching methods must be considered. At the same time, we must respect the students' individual interests and expertise. In addition to teaching, we also must provide as much scientific practice opportunity to student as possible and fully stimulate the student's inspiration and potential.

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REFERENCES

- [1] J.L. Zheng, The memory of writing and teaching—commentary on signal and system, Higher education press: Beijing, 2005
- [2] S.T. Chen, B.L.Guo, Signals and systems (third edition). Xi'an university of electronic science and technology press: Xi'an, 2008
- [3] H. J. Chen, Signal and system, Higher education press: Beijing, 2007
- [4] X.M. Jiang, G. Henkelman, G. Johannesson and H. Jónsson, in: Theoretical Methods in Condensed Phase Chemistry, edited by S.D. Schwartz, volume 5 of Progress in Theoretical Chemistry and Physics, chapter, 10, Kluwer Academic Publishers (2000).

- [5] R.J. Ong, J.T. Dawley and P.G. Clem, Journal of Materials Research (2003)
- [6] P.G. Clem, M. Rodriguez, J.A. Voigt and C.S. Ashley, U.S. Patent 6,231,666. (2001)