Discussion on Teaching Reform about the Course of Communication Principle Based on Excellent Engineer Training

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ABSTRACT

According to the requirements of "Excellent Engineer Education and Training Plan", this paper analyzed the teaching problems about the course of Communication Principle, and put forward the corresponding teaching reform scheme. The teaching methods of the course were improved from the aspects of teaching content and practice learning. Thus, students can firmly grasp the basic content of communication principle, and improve their theoretical learning and practical ability.

KEYWORDS
Communication Principle, Teaching Reform, Excellent Engineer.

INTRODUCTION

In order to cultivate and bring up a large number of high-quality engineering talents with strong innovation ability and adapt to the needs of economic and social development, the Ministry of Education launched the “Excellent Engineer Education and Training Plan” in 2010. In November 2013, the school of electrical and electronic information of Xihua University was approved the “Excellent Engineer Education and Training Plan” of Information Engineering at the provincial level. After more than 3 years construction of excellent program, our “Communication Principle” teaching team carried out some discussions and reforms on this course.

“Communication Principle” is the core course of communication engineering and information engineering that has strong theoretical and engineering application characteristics. The prerequisites for this course are “Probability and Statistics”, “Complex Function”, “Signal and System” and “Electronic Communications”. Follow-up courses are “Wireless and Mobile communication”, “Data Communication and Computer Network”, “Digital Communication” and “Modern Communication Technology”. This course is a link between the past and the future courses, and it is one of the most important courses of communication major. Its teaching quality has a great impact on students [1]. Therefore, it is very important to research how to cultivate and improve students' practical ability in the teaching of “Communication Principle”. To meet the latest needs of employers, and achieve the basic requirements of excellent engineers training, it is very important to give full use of professional knowledge in practical work [2].

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PROBLEMS IN PRESENT TEACHING

At present, there are the following problems of “Communication Principle” teaching:

(1) The teaching content of this course is not closely related to the previous relevant courses, which leads to the students’ lack of deep understanding in the theoretical part.

(2) Only by understanding the content of theory course by solving problems with skills, this kind of method makes it difficult for students to combine abstract knowledge with practice.

(3) Some teaching material lag behind the rapid development of science and technology in today’s communications industry, leading to the disconnection between book content and teaching content.

(4) The content of the course is mainly based on the basis of the experimental box.

THE THOUGHT OF THE TEACHING REFORM

Integrating the Teaching Contents

Different teaching materials have different angles of analysis, teachers can guide students actively to develop different thinking. At present, communication principle teaching materials such as “Modern Communication Principle” by Cao Zhigang, Tsinghua University, "Communication Principle (Fourth Edition)” by Zhou Jiongpan, Beijing University of Posts and Telecommunications, "Communication Principle (Seventh Edition)” by Fan Changxin, Xi’an Electronic and Science University, "Communication Principle (Second Edition)” by Li Xiaofeng, University of Electronic Science and technology of China, “A Concise Course of Communication Principles (Third Edition)” by Nan Liping, Beijing Information Science and Technology University, are all the most widely used domestic teaching materials, and foreign materials such as L. W. Couch’s “Digital and Analog Communication Systems”, Simon Haykin’s “Communication System” are widely used. The choice of our academy is “Communication Principles Course (Second Edition)” by Da Xinyu, Air Force Engineering University.

The “Communication Principle” includes analog and digital communication parts. And the analog modulation technology has been deeply explained in the earlier “Communication Electronic Circuit”. Therefore, when teaching the "communication principle", we can appropriately reduce the hours of analog modulation technology, and focus on analyzing the basic principles and operation modes of digital communication, deeply explaining the content of digital communication system. We can reduce the theoretical explanation of random signals and mainly introduce the conclusions [3].

It is very important to link book knowledge with the latest development and application of related technologies. For example, we can be expanding the practical application of various modulation technology, and integrating it into class. By complementing the current radio AM broadcast, stereo FM radio broadcast, analog television broadcast VSB in analog modulation system, students can familiarize with actual engineering parameters of analog modulation systems, such as bandwidth,
frequency offset, frequency modulation index, and the signal-to-noise ratio index and so on. In digital baseband transmission systems, we can introduce the application of raised cosine roll down filter in 3G communication system. In the teaching contents of 3G mobile communication system, we can add WCDMA and CDMA using BPSK, QPSK technology, TD-SCDMA using 8PSK, QPSK technology, 4G 64QAM technology and OFDM technology. By learning above contents, students can understand the needs of communications industry and the qualities required by communication engineers, their interest will be stimulated in professional learning, deepen their understanding of the communications industry [4].

In order to improve the students' learning interest in “Communication Principle”, we can encourage students to understand the historical development of the communications industry and celebrity anecdotes, such as Marconi’s experiment on radio communication, Bohr and Einstein's debate on quantum theory, the mother of CDMA-Heidi Rama’s WiFi technology, Armstrong's super heterodyne receiver etc..

Moreover, based on the important events of communication technology, we can combine the frontiers of communication technology that can guide students to carry out research on related topics and write summary report. Topics that can be studied, such as HUAWEI 5G channel coding Polar Code, 5G international standards, VR/AR applications, the development of optical network SDN, the large-scale applications of 100G-PON.

**Experimental Platform Based on Software Radio**

The current trend of teaching experiment of communication principle is to combine teaching needs with actual social needs, transform the development direction of experimental items from single verification to diversification (design, innovation and synthesis), build open laboratories and share experimental resources.

We can use the communication principle experimental platform UN that based on software radio architecture. Because its development process is consistent with the actual project development mode, students can quickly complete secondary development and validation on the hardware platform. It can satisfy the needs of students’ academic competition, teachers and graduate students in scientific research to a certain extent at the same time.

This platform combines real wireless signal with simulink simulation, not only reducing the learning threshold, but also taking account into the old experimental project before. It can also add the experimental items, such as software radio signal sampling theory, pulse shaping, digital down conversion, orthogonal modulation and demodulation, baseband carrier modulation and demodulation, channelized signal simulation, wireless transceiver integrated experiment.

The platform uses real wireless communication scenarios to communicate with the real commercial communication system on the market, such as connecting to real interphone directly, listening to FM radio music and so on. The experimental project covers from the basic modulation and demodulation to the 3G and 4G systems.

The further construction plan of the communication principle experiment part is to introduce “Internet +”, and “Intelligent Management”. The experimental platform is upgraded to remote experimental mode, so that students are no longer rigidly adhere to the laboratory and fixed experimental time, but can connect the experimental equipment through the Internet at anytime and anywhere. Expensive experimental
equipment has become accessible for those students who are interested in research and innovation.

**Make Full Use of Different Simulation Software**

In order to make students understand the boring theoretical content and get more profound understanding of the principles of communication after class, except the hardware experiment in the laboratory, we require students to use Matlab, System Vue and Labview to finish the simulation homework [5][6].

The content of the simulation, such as AM modulation in analog modulation, suppression of dual sideband amplitude modulation, SSB modulation and VSB modulation in the third chapters of Da Xinyu’s “Communication Principles Course (Second Edition)”. SNR and bit error rate of unipolar NRZ and bipolar NRZ, HDB3 code generation, raised cosine spectrum and time domain waveform, raised cosine roll-off system eye pattern in the fourth chapters about digital baseband transmission systems. Waveform and power spectrum of 2ASK, 2FSK, 2PSK, QPSK and 16QAM in the fifth chapters about digital band transmission system.

Students are required to write reports to show the simulation program, data and results, and to analyze the simulation results.

**CONCLUSION**

Through a series of improvement in the course teaching of “Communication Principle”, we made the boring communication knowledge become easier to understand for students, further improving students’ analyzing ability of communication theory and comprehensive application.

**ACKNOWLEDGEMENTS**

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