

# On Satellite Communications Course Reform in Universities of 211 Project

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**Abstract**—Satellite communications is not only a key technical for students who major in information subject must know well, but also a satellite cultural background course at the information age. Based on the current situation and characteristics of Universities of 211 Project, such as teaching objectives, course settings, and too much categories of professional courses but class hour reduced. From the point of view of teaching contents and methods, the reform contents and the characteristic requirements of the satellite communications course are presented, especially, the proposed reform to satellite communications materials and experimental content can meet the needs of the new times.

**Keywords**-Course Reform Satellite Communications Universities of 211 Project

## 1. Introduction

Satellite communications is a developed new way to communicate that in the widely integrated use of various communications theory and technology based on the terrestrial microwave communications and space technology, and it is an important achievement of modern communications technology. Compared with other means of communication, satellite communications has some incomparable advantages. After decades of development, it has become one of the most powerful modern means of communication, and be universally applied in international communications, domestic communications, defense communications, mobile communications, broadcast television and other fields.

The satellite communications course is not only a key technology for the students major in communications engineering, electronic information engineering and other similar professional subjects must master, but also a cultural background course of satellite at the information age. Presently, many colleges and universities in China, has opened satellite communications course in electronic and communications kinds of professionals. The currently used course materials mostly are written by Liu Guoliang[1], Wu Shiqi[2], Wang Bingjun[3], Gan Liang[4], Gan Liangcai[5] and Zhang Naitong[6] etc, respectively. Several colleges are also use materials abroad, such as satellite communications, compiled by Timothy Pratt etc[7]. But these can not meet the needs of advanced undergraduates in the new situation of the information age, because their contents are already outdated, redundancy, and there are too many repetitions with former course such as Communications Theory,

parallel courses such as Mobile Communications and Communications Network etc. neither do they reflect the rapidly development of various satellite communications systems nor many other issues.

Considering the characteristics of Universities of 211 project, such as the teaching objectives, course settings, and too much categories of professional courses but class hour reduced, we put forward some ideas for course reform in satellite communications, in order to compile the teaching materials and experimental content appropriately, design multimedia teaching system perfectly, fully embodies the characteristics of application oriented undergraduate education to improve the students' ability of analyzing and solving problem.

## 2. Problems need to be solved in Satellite communications course

### A. The handling of the teaching content

First, Satellite communications course combines completed courses and follow-up courses. It general reviews and applies the relevant content of completed courses in Satellite communications course, while hints the possible application of knowledge in the follow-up courses promptly if necessary; focused explanation and adequate practicing, increases the examples appropriately, analyzes and demonstrates the typical difficult assignment problems; helps students eliminate embarrassed emotion, promotes and mobilizes students' positive thinking and potential ability to give them a profoundly innovation nurtured.

Second, Union the theoretical teaching and practical teaching. In the process of theoretical teaching, should

related with practical engineering as much as possible, to stimulate students' interests in learning, so that can effectively reduce the actual distance between book knowledge and production / research.

#### *B. Improvements in teaching methods*

First, Adopt heuristic teaching and eliminate injection teaching in theoretical content. In class, teacher should pay attention to fully communicate with students, that is to say, students follow teacher's way of thinking, step by step, and accept knowledge. Teacher goes with students' facial expressions, read students and their mood, master the understanding / accepting level.

Second, Rational and scientific use multimedia teaching methods. Make the electronic courseware be clear, concise, visualize, excellent in both pictures and literary compositions, knowledge and difficulty points be lucid; Make the teaching organization be lively, vibrant, fascinating, and played an assistant role for assisted teaching, assisted learning and stimulate the enthusiasm of students, so that can effectively improve teaching effectiveness, and expand students' scope of the knowledge.

Third, Selection on experimental content, pay attention to the experimental process. Satellite communications experiment is an important learning understanding link of the satellite communications that consolidate and deepen the content of classroom teaching. Therefore, we must attach importance to the design and implementation of the experimental content, thereby enhancing students' cognitive abilities of high-tech products as well as practical ability, cultivating a scientific style.

### **3. Course reform contents and Characteristics requirements**

#### *C. Reform Objectives*

Course reform Objectives are to make the students master the basic principle and key technology of satellite communications, and improve the cultivation of students' application ability and innovation consciousness, to meet the talents market demand.

#### *D. Reform Contents*

First, Teaching Contents: follow the principles of necessity, creativity, scientifically and feasibility, serious research and carefully refine the course content of satellite communications, make it to be comprehensive, concise, systematic and scientific.

Second, Teaching methods: To explore the more reasonable and effective teaching means and methods, careful select the experimental course content, rational organize the experimental teaching, and to make the theoretical teaching and practical teaching combined organically.

Third, Teaching materials: Compile the materials supporting the syllabus, and strive to make the concepts and principles be strictly elaborated, accurate, concise, moderate theory, rich of examples and systematic, and avoid repeat with other courses. Embody the principles of scientific, systematic, integrity, and advanced, explain the profound but writing in simple terms, illustrated, step-by-step, easy be understood and self-learned, and design a perfect multimedia courseware.

#### *E. Characteristics requirements*

(1) View from the training: Satellite communications should be consistent with the characteristics and requirements in Universities of 211 Projects in China, such as teaching objectives, course settings, various professional courses but class hour reduced, make satellite communications to truly become the compulsory satellite cultural background course for electronic and communications undergraduates in the information age.

(2) From teaching purposes: Under the course teaching, let students to master the basic concepts and main technologies of the satellite communications systems, establish the complete concept of the communications systems, and to understand the current development of satellite communications.

(3) From relative basic course: This course is set up for the senior at the University, there are some completed courses, such as Signals and Linear Systems, Digital Signal Processing and Communications Theory. Therefore, the selected material and teaching are not duplication, that is, streamline the completed course contents, and can commence in parallel with the Mobile Communications, Communications Network, and other courses.

(4) From teaching hours and teaching methods: Due to the class hours of designated courses in general compression within 32-36 hours, too less for the content, teaching materials do compiled and refined to simplify the theoretical derivation and graphic description. Multimedia electronic courseware can also be applied for teaching.

(5) From teaching contents: Selected content must be comprehensive and concise, systematic and scientific. Textbook may be divided into five chapters. Chapter I Summary, represent the basic concepts, working principle, and development of the state at domestic and abroad of satellite communications systematically. Chapter II Satellite communications technology, a comprehensive exposition of the signal design technology, signal processing technology and multiple access technology in satellite communications, streamline the duplication of the completed courses. Chapter III Satellite Communications Link Design, meticulous introduce every section calculation in link design, outstanding the general procedure for the satellite communications systems design. Chapter IV Satellite Communications Network, describe the network structure of the satellite communications network,

terrestrial communications network links, and VSAT satellite communications network, highlighting the complete conception of communications systems. Chapter V Mobile Satellite Communications Systems, introduce a variety of new mobile satellite communications systems and developments, in order to reach the purpose of open eyes and improve innovation

Chapter	Abstract
1. Summary	1.1 Basic concepts and characteristics of Satellite communications; 1.2 Ground radio station; 1.3 Communications satellite; 1.4 Radio waves propagation and working frequency-band; 1.5 Developments of satellite communications
2. Satellite Communications Technology	2.1 Signal design technology (modulation and coding); 2.2 Signal processing technology; 2.3 Multiple access technology
3. Satellite Communications Link Design	3.1 CNR in receiver input; 3.2 C/T value of Satellite communications link; 3.3 Calculation on digital satellite communications link
4. Satellite Communications Network,	4.1 Network structure; 4.2 Connection between Satellite Communications Network and Ground-based communications network; 4.3 VSAT satellite communications Network; 4.4 Typical satellite communications Network Systems
5. Mobile Satellite Communications Systems	5.1 International mobile satellite communications systems; 5.2 Geo stationary regional mobile satellite communications systems; 5.3 Low earth orbit mobile satellite communications systems; 5.4 Medium earth orbit mobile satellite communications systems; 5.5 Satellite navigation and positioning systems

No.	Experiment name	Experimental content and requirements
1	Installation on satellite receiver antenna systems	Master antenna installation, antenna angle design and antenna direction selection in satellite receiver
2	Satellite receiver debugging and site debugging	Master the signals receiving method in satellite receiver, and familiar with the reception debugging
3	Installation and debugging on Satellite IP receiver assemble	Master the installation, use, and receiving process debugging of Satellite IP receiver
4	Satellite position tracking and memory setting	Use locator to track satellite and set location memory

sense.

To this end, we accumulated long-term experience in teaching, and applied it in satellite communications teaching materials preparation for Universities of 211

Project [8], its content of teaching arrangements shown in Table 1. At present, this published textbook is widely used in countrywide and gets a very good affection feedback.

(6) From the experimental content arrangements: Experiment is an important understanding session of learning satellite communications, which can help students to consolidate and deepen the content of classroom teaching, enhance students' cognitive and practical abilities of high-tech products, and foster a scientific style. Therefore, we must attach importance to the experimental design and implementation in the course. if experimental courses can be set to 6-8 hours, for example, can be arranged in accordance with Table 2 shows, the content of these experiments enable students to master the debugging of satellite signals, installation of satellite antenna, as well as satellite positioning technology.

TABLE I. CLASSROOM TEACHING CONTENT FOR SATELLITE

TABLE II. EXPERIMENTAL CONTENT OF SATELLITE COMMUNICATIONS

## 4. Summary

Considering the Universities of 211 Project's teaching objectives, course settings, and too much categories of professional courses but class hours reduced, we must explore the better suitable teaching contents and methods for undergraduates, and organize experimental teaching rationally, make the theoretical teaching and practical teaching combined organically. Appropriate course materials, well-designed multimedia teaching systems and explore a more rational and effective teaching means and methods are necessary. In order to enable students to master the basic principles of satellite communications, key technologies, and its development trend, we must strengthen the cultivation of students' application skills and sense of innovation, to accommodate the demands of today's talent market.

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