Reform of Three Comprehensive Education in Optoelectronics Curriculum Group under the Background of Engineering Education Professional Certification

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Abstract: The certification of engineering education majors require graduates to be able to adapt, support, and lead the development of new economy, new technology, new industry, new ecology, and new models, and cultivate the ability of engineering graduates to solve complex engineering problems. The optoelectronic course group needs to be based on industry and industry development, focusing on the knowledge needs of enterprises for engineering talents, transforming "subject driven" training into "demand driven" training, and following the principles of "student-centered, result oriented, and continuous improvement" for course reform and practice. Feasible solutions are proposed for the pain points and internal development issues that need to be paid attention to in the current construction of three comprehensive courses in the optoelectronic course group. Effective ways to combine three comprehensive education with the content of this course are explored, and three comprehensive content that is combined with this course is proposed. Examples of how to implement three comprehensive education in this course are given with optoelectronic products that students often meet. After implementing three comprehensive education in the curriculum, the teaching effectiveness has been significantly improved, and students' interest in learning the optoelectronic course group has significantly increased, resulting in a significant improvement in academic performance.

Keywords: Engineering Education Certification; Curriculum Education; Curriculum Group; Optoelectronics, Teaching Philosophy; Connotative Education

1. Introduction

The curriculum of three comprehensive education is centered around the three comprehensive education courses, with professional courses, general education courses, and three comprehensive education activities integrated around it to construct a concentric circle of three comprehensive education. It is necessary to play its three comprdhensive education function, so as to enable students to form the correct three perspectives of "worldview, values, and outlook on life" [1-4].

From the "Fudan Consensus", "Tianda Action" to the "Beijing Guidelines", We are fully exploring the Chinese model and experience of engineering education, actively responding to the new round of technological and industrial revolution, and supporting the national strategy of "Made in China 2025". Since China officially joined the Washington Accord in 2016, engineering education professional certification has entered a new era. Domestic higher education researchers have conducted OBE research on multiple courses, majors, and disciplines. The OBE concept has been widely applied in the formulation of teaching plans, curriculum teaching reforms, and assessment and evaluation reforms for engineering majors in China, and has achieved good teaching results [5-7].

Course groups can be used for modular teaching, with the characteristics of mutual intersection, infiltration, and integration, fully demonstrating the advantages and effectiveness of course group education and teaching [8-11]. As one of the core foundational courses in electronic information majors, the optoelectronics course group is a course that closely connects theory with practice. This course group focuses on the characteristics of various optoelectronic components involved in the development of

the optoelectronic industry, enabling students to master the theory and application technology in the field of optoelectronic technology, laying a solid theoretical foundation for future research and work.

2. The Course Three Comprehensive Content of the Optoelectronic Course Group

As a fundamental and specialized course, the optoelectronics course group has strong theoretical and practical characteristics, and the course involves a lot of concepts and device principles. The course studies the micro interactions between light and matter, based on optics and electronics, and comprehensively utilizes knowledge from disciplines such as optics, electronics, and materials science to solve various optoelectronic engineering application problems. The course requires students to master the basic concepts, theories, device structures, and working principles of optoelectronics, and understand the inherent connections between various optoelectronic effects. In the teaching and learning of theoretical courses, students generally feel abstract and the relevant theories are relatively dull. At the same time, the optoelectronics course requires students to be able to assemble and debug a certain type of optoelectronic product in real life after completing a knowledge module, achieving the effect of testing theoretical knowledge and cultivating practical operational abilities. The three comprehensive content of this course group is determined as follows:

(1) This article elaborates on the development process of optoelectronic technology from the characteristics, inventions, and applications of optoelectronic devices. Combining with the current development and core competitiveness of optoelectronic products in China, it explores that the great rejuvenation of the Chinese nation and the "Chinese Dream" require the younger generation to take on the role of relay.

(2) The application of dialectics, social and ecological principles in a closed-loop system teaches students how to adapt to society.

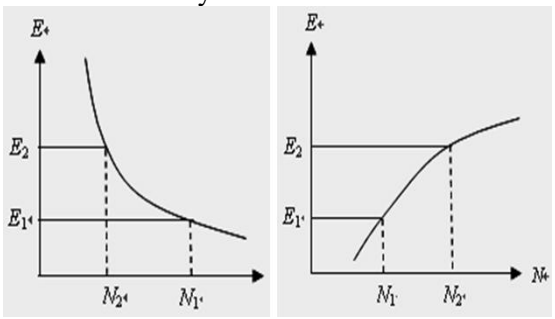
(3) Combining the widespread application of optoelectronic technology in China's daily life and industrial production, we encourage students to use the content of this course to think and improve optoelectronic products, and serve society.

(4) Combining the application of optoelectronic display technology to enhance awareness of energy conservation and environmental protection.

3. Course Three comprehensive Practice of Optoelectronics Course Group

3.1 Combining the principles of devices with the laws of life and the development of the times

Laser is one of the most important knowledge modules in the optoelectronic course group. To generate laser, two necessary conditions need to be met: inversion of particle number distribution and reduction of oscillation mode number. When distributed normally, the number of particles in low-energy level E1 is much higher than that in high-energy level E2 (Figure 1a). At this time, external light excitation only produces stimulated absorption effects, consuming photons and not producing them. Under the action of the pump source, the particle number achieves an inverted distribution, and the number of particles in the high-energy level E2 is much higher than that in the low-energy level E1 (Figure 1b). At this time, external light excitation will generate stimulated radiation effects, producing more photons and achieving light gain, thus providing the possibility for laser generation. This section can guide students to respect the natural laws of things and make good use of them. Just like the accumulation of particles on the high-energy E2, the inversion of particle numbers can only be achieved at a certain time.



(a) Normal Distribution (b) Reverse Distribution

Figure 1. Distribution of Particle Numbers at Different Energy Levels

During university, students will learn a lot of knowledge, which may not reflect its value in the short term. The accumulation of knowledge will inevitably go through a process, and the learning of theoretical knowledge will also undergo a process from quantitative to

qualitative change. Through long-term and unremitting efforts in learning, students will achieve a major breakthrough and lay a solid foundation for future success.

3.2 Integrating Course Concepts with Humanities and Society

The condition for interference between two rows of light waves is that they have the same frequency, vibration direction, phase, or constant phase difference (Figure 2). The condition for the interference light to be longer is that the optical path difference between two columns of light is an integer multiple of the wavelength of the light wave, i. e. r2 - r1 = $m\lambda$, where m is a natural integer, λ Is the wavelength. Class development and team building are like interfering with light. Only when all members maintain the same goals and work at the same pace can great construction results be achieved. It also requires students to maintain unity and effort with their classmates, colleagues, and elders in future learning, work, and life, which not only builds a good team but also enhances their own abilities.

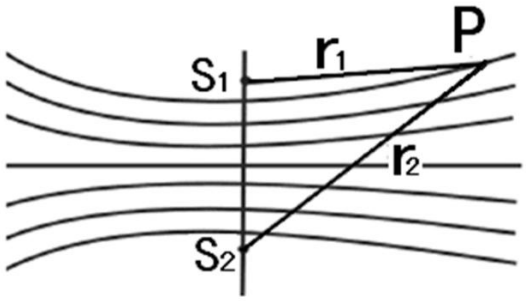


Figure 2. Conditions for Interference Length

Polarized light is a very important source of light waves. When the vibration direction of the transverse wave is perpendicular to the orientation of the slit, the transverse wave cannot pass through the slit; When the vibration direction of the transverse wave is at a certain angle to the orientation of the slit, only a portion of the transverse wave passes through the slit; Only when the vibration direction of the transverse wave is consistent with the orientation of the slit can the transverse wave pass through completely, while the longitudinal wave does not have this requirement when passing through the slit. Many students cannot understand the concept of polarized light very well. In class, a cartoon (Figure 3) was added to help students understand the concept of "Don't carry a pole with your waist crossed and can't enter the city gate". The explanation of this teaching content in class and the introduction of human success cannot be separated from social laws. Longitudinal waves are like highly intelligent geniuses, they are more likely to achieve success than ordinary people. But most students are ordinary people, just like a horizontal wave. To achieve success, only by establishing personal life goals on the basis of serving society can your life "shoulder pole" smoothly enter the door of "success"; If we only focus on creating new and innovative landmarks, there will be a situation where we cannot enter the city gate with our backs crossed and our poles carried.

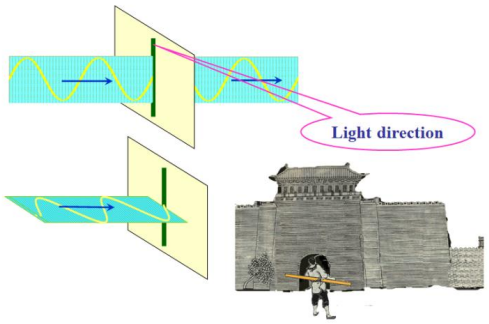


Figure 3. Polarized Light and Slit

3.3 Based on the Application of Optoelectronic Devices, Describe the Development of Chinese Technology and Social progress

Fiber optic communication is the core knowledge module of the optoelectronic course group, and the successful preparation of low loss optical fibers is a milestone in the development of fiber optic communication. The level of fiber optic loss directly affects the transmission distance or the distance between relay stations. As early as 1966, Dr. K. C. Kao, a British Chinese, pointed out based on the theory of dielectric waveguides that the high loss of optical fibers is not inherent, but caused by impurities in the material. He predicted that reducing the impurity content in the material could reduce the loss of optical fibers to 20dB/km, or even lower. In 1970, Corning Glass Co. , Ltd. in the United States successfully developed a low loss quartz fiber with a loss of 20dB/km, which made the fiber fully capable of serving as a transmission medium for optical waves and opened up a new era in fiber optic communication.

Professor Yang Zhenning highly praised Gao Kun's achievements in scientific research, stating that his research on optical fibers has greatly changed human life and made great contributions in the fields of communication technology and medicine. It is precisely because of Dr. Kao Kun's outstanding contribution in the field of optical fiber - bringing the earth into the Internet era, he won the honorary title of "the father of the world's optical fiber" and the 2009 Nobel Prize in physics. The success of Gao Kun in the field of fiber optic communication has enabled Chinese people to stand at the top of the world's technology, while also providing a strong shot in China's scientific research work.

3.4 Combining Optoelectronic Display Technology to Enhance Awareness of Energy Conservation and Environmental Protection

In recent years, the optoelectronic display technology that has been in close contact with people's lives is television. Teachers can combine their own experiences to explain how cathode ray TVs with large screens accompanied family life in the 1970s and 1990s, and explain their high energy consumption, large size, and unattractive issues in conjunction with optoelectronic displays. After the 21st century, LCD televisions have entered households. The thickness of televisions has been greatly reduced, and there is no need for high-voltage packaging during the display process, resulting in a significant reduction in energy consumption. In the past decade, LED and OLED televisions have further improved the picture quality and reduced energy consumption of televisions. From the working principle of television, students should understand which components consume electrical energy during the operation of the television. The development process of television is actually a process of reducing electrical energy consumption. At the same time, it is necessary to understand from the circuit principle how electrical energy is consumed after standby, thereby improving students' awareness of energy conservation and consumption reduction, and cultivating good electricity habits.

4. Analysis of the Effect of Course Three Comprehensive Education

Through the introduction of three comprehensive education in the curriculum, positive three comprehensive elements have been added to the optoelectronic course group classroom, which has received good feedback from students and greatly improved teaching effectiveness. It is reflected in the following three aspects:

① In the classroom, students not only learn the professional knowledge of the course, but also receive subtle three comprehensive guidance, changing the dull and boring learning atmosphere of professional courses in the past, making the classroom more interesting and full of vitality, and enhancing students' sense of identity and mission towards their profession and even the nation;

② Introducing engineering cases that are closely related to student life to carry out situational introduction teaching, allowing students to discuss in groups, cultivate a spirit of unity and cooperation, strengthen the learning of safety awareness, standards and technical specifications, guide students to attach importance to engineering professional ethics and industry regulations, and enable them to better understand the role of the optoelectronic industry. They are also more willing to work in the optoelectronic industry after graduation;

③ By watching the content of optoelectronic products in documentaries such as "Craftsmen of the Great Country" and "Heavy Industries of the Great Country" after class, we can inspire students' patriotism, enhance their sense of professional and even national identity and mission.

5. Conclusion

Although the optoelectronic course group is a fundamental course with strong engineering attributes, its comprehensive education function is not lacking. The author closely focuses on the goal of cultivating professional talents in teaching, integrates three comprehensive content into the curriculum system, and consciously, systematically and systematically integrates professional teaching content and three comprehensive elements; While adhering to professional positioning, integrating core values into the classroom, reflecting three comprehensive education in

teaching practice, cultivating students' professional ethics, patriotism, and sense of responsibility and mission. The construction of three comprehensive education in the curriculum requires professional teachers to consciously collaborate with educators in the three aspects to do a good job in education, build a pattern of all-round education for all staff, the whole process, and achieve the goal of cultivating high-quality talents.

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