

# Reform and Practice of “Wastewater Engineering” Based on Engineering Specialized Accreditation

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**Abstract**—Specialized Accreditation improves the quality of engineering education by building monitoring system for higher engineering education. The existing problems and deficiencies of professional education are reviewed through the engineering education accreditation. Wastewater Engineering (volume I) is a selective environmental engineering course for students. Considered the student needs, the optimization of curriculum system and innovation of talent training mode can contribute to better train talents and more conducive to professional development. Taking Qingdao University of Science & Technology as an example, the reform and practice of the course “Wastewater Engineering (volume I)” are explored in the context of engineering professional accreditation. It could serve as a reference for the cultivation of high quality environmental engineering talents with equal emphasis on knowledge and ability.

**Keywords**—Engineering Specialized Accreditation; Environmental engineering; Wastewater engineering; Reform and Practice

## I. INTRODUCTION

Accreditation is a voluntary, nongovernmental process that includes a rigorous external review of a school’s ability to provide the highest quality programs. The accreditation process is a comprehensive review of a school’s mission, faculty qualifications, and curricula, and the process includes self-evaluations, peer-reviews, committee reviews, and the development of in-depth strategic plans. Accreditation ensures that students are learning material most relevant to their field of study, preparing them to be effective leaders upon graduation [1-3].

The course “Wastewater engineering (volume I)” covers the design of wastewater pipeline system, storm pipeline system and combined pipeline system, infrastructure and material of sewerage system. The major objective of this subject is to provide the fundamental knowledge of planning and design of sewerage system. The students are required to have the ability of designing the sanitary sewer system, storm sewer system and combined sewer system.

In this paper, the reform of the Course “wastewater engineering (volume I)” are practiced through the Engineering Specialized Accreditation. We analyze the advantages and disadvantages of the current evaluation with the requirements engineering education professional certification, conduct

research and practice about the evaluation methods of the course of “wastewater engineering (volume I)”.

## II. REFORM AND PRACTICE OF THE COUSE

### A. Adjust teaching plan

The content of “wastewater engineering (volume I)” are constantly changing, the textbook changed from the initial third to fifth edition. New technologies, new materials continue to appear in this field. The new knowledge must be reflected in the teaching. Through accreditation, the level of teachers’ knowledge must continue to improve; otherwise, the students can’t learn new knowledge to catch up with the social development and meet the needs of the work.

For example, in recent years, the sponge city has grew up, Sponge is refers to the city like a sponge, adapt to environmental changes and respond to natural disasters, etc., with good “flexibility”, the rain water, water storage, water seepage, water purification, the accumulation of water when necessary and take advantage of “free”.

Teaching plan:

Chapter 1 Introduction of water supply and drainage system (1class hours)

Chapter 2 Drainage system introduction (4 class hours)

2.1 The development course of drainage system

2.2 The main part of the drainage system

2.3 The choice of drainage system

2.4 Arrangement of drainage system

Chapter 3 The design of the sewage pipeline system (10 class hours)

3.1 To determine the survey and design scheme of design data

3.2 Determination of design flow of sewage

3.3 calculation of sewage pipe

3.4 The design of the sewage pipe

3.5 Draw the sewage pipeline plane and profile.

3.6 Example of design of the sewage pipe

Chapter 4 The design of rainwater drainage system. (8 class hours)

- 4.1 Analysis of rainfall and rainstorm intensity formula
- 4.2 Determine the rainwater conduit design flow
- 4.3 Design and calculation of rain water pipe system

Chapter 5 Combined design of drainage system (4 class hours)

- 5.1 Combined use of conditions and layout characteristics of pipe drainage system
- 5.2 Combined the design flow for sewerage
- 5.3 Hydraulic system of sewerage calculation confluence

Chapter 6 Auxiliary structures and drainage material drainage channel system (3 class hours)

Chapter 7 the sponge city (2 class hours)

### B. Adjust teaching method

Teaching method comprises the principles and methods used by teachers to enable student learning. Suggestions are there to design and selection of teaching methods must take into account not only the nature of the subject matter but also how students learn. In Specialized Accreditation, the trend is that it encourages a lot of creativity. The approaches for teaching have to be changed from teacher centered to student centered. In Student-Centered Approach to Learning, while teachers are the authority figure in this model, teachers and students play an equally active role in the learning process. The teacher's primary role is to coach and facilitate student learning and overall comprehension of material. Student learning is measured through both formal and informal forms of assessment, including group projects, student portfolios, and class participation. Teaching and assessments are connected; student learning is continuously measured during teacher instruction [4]. Commonly used teaching methods may include class participation, demonstration, recitation, memorization, or combinations of these.

Specialized Accreditation emphasizes continuous improvement. In order to ensure the graduation requirements, the teaching process quality monitoring and graduate tracking and feedback mechanism has been established. Regular visits to employers and enterprises are used to evaluate the achievement of graduation requirements. This course will also be based on the established mechanism of continuous improvement, through the feedback information in the teaching, to clear the course objectives of the course, to continuously reform the teaching content and teaching methods, and to improve the quality of teaching [5-6].

Through Specialized Accreditation, we connect this course with curriculum design. The students have to design Drainage system of a town in the South within two weeks. The design principles of drainage planning, drainage system selection, design flow calculation of sewage pipelines, pipeline layout and hydraulic calculation are investigated. After curriculum design, practical ability and some basic skills are improved, so that the ability of engineering practice is obtained. Besides, the

Knowledge structure can meet the needs of social development, and fulfill the objective of cultivating expert professionals in engineering application and technological innovation.

### C. Evaluation

The testing problems of "wastewater engineering (volume I)" mainly is heavy shares of memorizing contents in the test paper. One test decides the final grades, the single testing way stand in the way of developing originality and creativity. Specialized Accreditation proposes offering more exam varieties for teachers to select in accordance with their course natures. Raising the shares of assignments in the whole course grades and giving students more quizzes will promote their initiatives in their everyday studies and prevent the teaching methodology of talking-all-the-time and further provide them more opportunities to do two-channel communications with teacher and demonstrate their creativity as well, so as to meet the needs of the credit system reforms at colleges and universities. After reform, now the percent of attendance and class performance is 10%; the percent of homework is 20% and the final exam is 70%.

The second semester in 2017-2018, the question types of exam are divided into four questions: filling in, judging, answering and calculating. The examination content of this course focuses on assessing the ability to understand, analyze and calculate their contents. The design and calculation methods and design points of sewage pipes, storm water pipes and combined drainage pipe and drainage systems are mainly examined. Examination contents and questions can comprehensively examine students' ability to understand, analyze, calculate and synthesize teaching contents. The proposition covers all chapters of this course, and focuses on the design method of drainage pipe and canal system design flow, hydraulic calculation and design, which is in line with the requirements of the syllabus.

The third main questions are as follows: A certain area has a large terrain slope. The new drainage system in the New District of the area is designed. Answer the following questions. (25 points)

1. The annual rainstorm intensity of 0.8 mm/min is 5%, and the corresponding recurrence period is how many years? (2 points)
2. The proportion of greening area in the new urban area is much larger than that in the old urban area, and the runoff coefficient in the new urban area is higher than that in the old urban area. (1 points)
4. The slope of the terrain is large, and the time for collecting water on the ground should be smaller or larger? (1 points)
5. Rainwater pipeline connection method is generally adopted? (1 points)
6. The function of the rain drainage system is to set up the inspection well? (2 points)
7. How to divide the design pipe section into the drainage system? (4 points)

8. What is the difference between the design requirements of the storm water pipes and sewer pipes? And explain the reason. (7 points)

9. What are the hydrological characteristics before and after the development of sponge city? What are the ways to build the sponge city? (8 points)

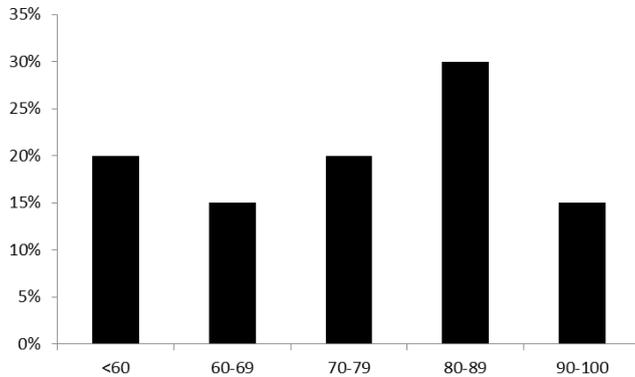


Fig. 1 The distribution of examination results in 2017

From the distribution of examination results, scores are basically normal distribution, and the percentage of failing grades is high. Many students do not know how to divide the sewage design pipe section. The students have good knowledge of the design of rainwater pipes and canals; among them, seventh of the third questions have lost more points. Most of the students can't express the meaning of the recurrence period of rainstorm intensity. Most of the students have mastered the calculation of the design flow of the sewage pipe, the minimum buried depth calculation of the sewage pipe and the connection of the upper and lower reaches of the pipe and the calculation method of the design flow of the rainwater pipe and canal. According to the results of classroom teaching, classroom test, homework and final examination, most students have high enthusiasm in learning this course. Students have a good grasp of the basic concepts of drainage system, key points of design, and the design and calculation of drainage pipes and canals, and can achieve the expected teaching effect. Classroom test results were higher than in previous years, reflecting that most students pay more attention to their usual learning. However, many students lack initiative and lack interest in professional courses.

#### D. Continuous improvement

After a year's practice, the following teaching improvement measures are put forward.

In the course of teaching, the new standards and new policies are introduced into teaching in close combination with the development trend in the field of drainage, so that students can get the latest information in the field of professional development in time and stimulate the students' awareness of innovation.

In order to improve the students' engineering design ability, the teaching methods should be improved actively. In view of the strong practical characteristics of this course, the engineering cases are added to the teaching process, and the theoretical knowledge and practical engineering are integrated in order to improve the students' ability to solve practical engineering problems.

We should strictly request students in the whole process of teaching, increase the number of classroom tests, and urge students to pay attention to their usual learning.

### III. SUMMARY

High quality of practical course system for environmental engineering is intended to construct based on requirement of Specialized Programmatic Accreditation of Engineering. Based on analyzing requirements of professional core curriculum system listed by the Engineering Education Professional Certification Standards, preliminary exploration and practice were done on the professional core curriculum system setting and content of courses optimization of Environmental Engineering in Qingdao University of Science and Technology. The curriculum is combined with the requirements of the certification of engineering education. A reasonable evaluation index system for curriculum evaluation is established. The process of assessment is diversified and practical, after 2017 years of teaching. The practice has proved the feasibility of the system, which will help train students to solve problems. Complex environment engineering problems and promote professional education through continuous improvement. To effectively integrate with enterprises, enhance the international competitiveness of engineering graduates.

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