

# Improve the teaching effect of mechanical design course

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**Abstract.** In order to improve the teaching effect of mechanical design course, this paper discusses the teaching process from six aspects. It mainly includes the setting of basic courses, the revision of teaching plans and syllabus, the teaching of practical links, the experimental teaching of design courses, the integrated teaching process and the course design. It is the way to improve comprehensive quality of students. Through the combination of theory and practice, we pay attention to strengthening students' ideological and political education and cultivating their innovative ability. Mechanical design plays a very important role in mechanical engineering technicians and mechanical industry. Therefore, it is of far-reaching significance to do a good job in the teaching of mechanical design.

## 1 Introduction

Mechanical design has many general parts in the course of mechanical design. These parts are widely used in various machinery and equipment, but it is difficult for students to learn mechanical parts due to their lack of understanding. Although in the teaching system of mechanical specialty, some relevant professional basic courses have been studied in the teaching before the mechanical design course, due to the large content of mechanical design course and the limited teaching hours, the students' perceptual knowledge of parts and components is not enough, and the teaching is relatively difficult. If you don't make careful preparation and visit and study relevant mechanical parts, you can't better understand and master the content of mechanical design. The same is true for the study of some special parts. For example, for the structural design of shaft parts, the positioning mode and fastening method of shaft parts should be reasonably arranged, so that the installation and disassembly of shaft parts should be relatively easy and easy for assembly and maintenance. These require close integration with practice. Due to the strong practicality of mechanical design course, strengthening and practical teaching links and combining theory with practice are very helpful to the teaching of mechanical design course. The teaching of mechanical design course should start with strengthening practical teaching links and pay equal attention to theory and practice, so as to improve the teaching quality of mechanical design course.

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## **2 Prerequisite courses offered**

The explanation of mechanical design course requires the comprehensive use of basic knowledge such as advanced mathematics, engineering drawing, engineering materials, interchangeability and measurement technology, theoretical mechanics and material mechanics. The knowledge of this kind of prerequisite course is very important as the basis of mechanical design course. Learning is a gradual process. If the foundation is not firm, the house will collapse if it is built askew; To encourage others is counterproductive. In the teaching plan, the above prerequisite courses must be arranged before the mechanical design course, so as to make sufficient knowledge reserves for learning the mechanical design course. The lack of prerequisite courses and insufficient class hours have brought difficulties to the explanation and learning of mechanical design courses, and students feel at a loss about their understanding of some concepts. For example, in the teaching content of compression mechanics, if students do not understand the stress diagram, internal force diagram and strength theory, they will make mistakes in the structure and strength design of shaft parts.

## **3 Revision of teaching plan and syllabus**

When formulating the teaching plan and syllabus, the teaching hours of each course shall be reasonably arranged due to the restrictions on the total credits of the talent training program and other factors. And the necessary class hours of this course. Reducing the class hours of prerequisite courses will inevitably bring difficulties to subsequent learning. Due to the limitation of total credits, it is impossible to guarantee the class hours of prerequisite courses, so a certain class hour shall be reserved to make up for the lack of relevant contents of prerequisite courses in the teaching of mechanical design, so as to ensure the integrity and continuity of the teaching process of mechanical design. Teachers should carefully analyze teaching requirements, choose teaching contents, highlight teaching priorities, teach students according to their aptitude, treat students differently at different levels, and formulate a more reasonable syllabus to ensure teaching quality.

When making teaching plans, we should pay special attention to the teaching of practical links. We should not only ensure the teaching time and teaching quality of the experimental course, but also ensure the time of the course design link and the completion of the teaching task of the course design.

For the arrangement of experimental courses, at least 8 class hours and 4 experiments shall be arranged. The Secretary divides the students into several groups to improve the teaching effect. Each student should guarantee to do 4 experiments and 8 class hours.

For the teaching of mechanical design course design, we should also formulate teaching plans and syllabus to ensure the supply of teaching hours, teaching facilities and teaching tools. The teaching of mechanical design course design in the Department of mechanical and electrical engineering of Tan Kah Kee College of Xiamen University is specially arranged to be completed in the practice week. For the mechanism specialty, it is required to design the secondary reducer, arrange the design task one month in advance, and arrange two weeks to complete the task of course design after the completion of theory teaching and examination.

## **4 Teaching in practice**

According to the teaching plan of mechanical specialty, visit study and metalworking practice are arranged before the mechanical design course.

#### **4.1 Visit and study**

Since most students have not been to the machinery factory before going to college, many mechanical equipment, parts and components have not been seen, and the working conditions of some mechanical equipment and the functions of parts and components are not clear. I have a preliminary understanding of mechanical parts and drawing standards after learning in college. At this time, students can be arranged to visit and study in the machinery factory. During the visit and study, you can come into contact with many mechanical equipment and understand the current development of machinery enterprises, which is helpful for future study and job hunting. Safety education and mobilization shall be carried out before the visit, so that the students can abide by the factory safety system and procedures to avoid danger. During the visit and study, the instructor or enterprise technicians can make some explanations to make the students understand the key equipment and general parts. For some visible transmission mechanisms, you can briefly introduce their names, classifications, working principles and application occasions, so as to make students interested in various mechanical transmission and promote their future study.

#### **4.2 Metalworking practice**

Metalworking practice is a very important part of teaching practice. In metalworking practice, students should learn the operation and maintenance methods of several types of machining equipment. In the specific operation and use, I have close contact with various transmission mechanisms and common parts, and have a preliminary feeling of their name, type and application. This experience is very necessary for future teaching links.

Students can process reducer shaft, gear and other parts during metalworking practice, which is very beneficial to the teaching of subsequent mechanical design. During the internship, the students processed many parts of the reducer. These parts are made of non-metallic materials, and then assembled. Multiple reducers can be assembled as teaching models for teaching. In the process of production and disassembly, the students have a deeper understanding of the basic mechanical parts and a clearer understanding of the design of the reducer.

### **5 Experimental teaching of design course**

Before the course design of mechanical design, there is the course design of mechanical principle of mechanical drawing, which is closely related to the content of mechanical design course. Mechanical drawing operation is to draw the assembly drawing of mechanical device from the perspective of drawing. Mechanical device contains many mechanical parts and components, and the most basic is general parts and components. Therefore, mechanical drawing operation is mainly the drawing of general parts and components.

The students of mechanical and Electrical Engineering Department of Tan Kah Kee college have made remarkable achievements in CAD competitions at all levels. CAD association has a special design room, which often organizes learning and exchange activities of various drawing software, which improves the students' design ability.

Through experimental teaching, students can preliminarily master the structural analysis and design methods of common transmission mechanisms, and master the working principle, characteristics, type selection and calculation methods of some general parts and components; Cultivate students' ability to use the basic knowledge learned to solve practical engineering problems; Cultivate students' ability to design mechanical transmission

structure, analyse some typical parts and components, and put forward improvement measures. So that students can understand the experimental process of common mechanisms, parts and components; Preliminarily master the performance test and structural analysis methods of some parts and components, and deepen the understanding of the theoretical knowledge learned.

As a student majoring in mechanism in Tan Kah Kee College of Xiamen University, the mechanical design course arranges four experiments: bolt connection and belt transmission experiment, chain and universal joint transmission experiment, reducer assembly and disassembly and structural analysis experiment, and spiral spring characteristic analysis experiment. The students of near machine class arrange four experiments: transmission experiment, gear experiment, mechanism model visit and design, processing equipment visit and CAM programming. Experimental teaching is very helpful for theoretical teaching, and the two complement each other. For example, through observation and analysis, preliminarily estimate and measure the modulus of gear, so as to have a better understanding of gear parts.

## **6 Integrated teaching of mechanical design**

From the overall point of view, - one is the design idea of full capability. From the market research and feasibility demonstration, put forward the overall design scheme and carry out technical demonstration. In the world bank layout design, first design the executive components, select the appropriate basic mechanism, combine and innovate the executive mechanism, realize the desired motion law of the executive components, then design the power system and select the appropriate power source, Then the transmission system is designed to transmit power and motion to the door actuator.

Mechanical design is the design of the whole machine. All components should be able to realize the most worrying of the whole and have a systematic concept. Through the "black idea", the design task can be clarified. Through the morphological matrix and system decomposition, a variety of design schemes can be determined, and then various schemes can be analysed and compared to determine the most existing solutions.

Design and mechanics, engineering graphics, interchangeability, engineering materials and other courses. Students are required to learn this course on the basis of learning each course well.

Innovation is a necessary way for the human world. We should pay attention to cultivating students' innovative consciousness and spirit, observe and think more in real life, and pay attention to the teaching of innovative formula at the same time.

In mechanical design, various basic mechanisms should be familiar with and mastered first. Through the arrangement and combination of different mechanisms, we can realize the motion law we want, so as to achieve our design purpose. Combination is innovation. We can use TRIZ theory to invent the problem-solving principle, analysing the body and problem, and find out the solution.

Through the mechanism regeneration principle, we can also carry out rod type matching and topology analysis on the existing mechanism, find out a variety of schemes, add constraints, and design new mechanisms. The structure can also be designed innovatively, such as screws. Through analysis, we can improve the design of its head, tail and middle respectively, and design a new screw.

## **7 Course design of mechanical design**

The course design of mechanical design is arranged in a special teaching practice week after the theoretical study of mechanical design course. It is not only the last important teaching link of mechanical design course, but also the training of students' comprehensive design ability. The purpose of mechanical design course design is to consolidate, deepen and expand the basic knowledge of mechanical design through course design; Develop the design skills of actual parts; Train the ability to comprehensively use theory to analyse and solve various problems.

By formulating the design scheme, reasonably selecting the type of transmission mechanism and parts, correctly calculating the working capacity of parts, determining the size and selecting materials, and comprehensively considering the requirements of manufacturing process, use and maintenance, carry out structural design and complete the design task.

In the above-mentioned practical teaching links, we often encounter a large number of general parts. Through their learning cognition, we can deepen students' perceptual understanding of general parts and components and lay a good foundation for the study of follow-up courses. In short, we should strengthen practical teaching and improve students' perceptual knowledge and learning interest, so as to make them understand and master the course of mechanical design.

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