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Instructional Program for Comprehensive Machine Manufacturing Practical Training

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Abstract

To begin, the role and positioning of comprehensive practical training in mechanical engineering teaching system are planned, as is the teaching purpose of comprehensive practical training in mechanical engineering. Second, on this basis, the teaching contents of comprehensive practical training in mechanical manufacturing are detailed planned in four aspects, and methods for implementing the teaching contents are provided. Finally, for many years of actual implementation, the verification of the implementation effect on the teaching contents is provided.

Keywords: Engineering training, Practice, Machine, Manufacture, Technology.

1. Introduction

One of the required core practical courses for mechanical engineering majors is comprehensive practical training in mechanical manufacturing. This course serves as a crucial

practical teaching link to foster students' ability to connect theory with practice and enhance practical hands-on operation. Few institutions provide students actual hands-on experience, while most students visit the production site to learn about component manufacture. This internship plays a crucial part in the mechanical engineering curriculum by giving students the chance to interact with real-world manufacturing expertise. The simple mechanical manufacturing process internship must be enhanced with its new engineering concepts as a result of the advancement of engineering education, since it no longer meets students' demand for practical understanding of mechanical manufacturing. On the basis of meticulously preparing its training content, it is required to expand its knowledge base and turn it into complete practical training in mechanical production.

Currently, there aren't as many academic research on the subjects of comprehensive practical training in mechanical manufacturing, and the majority of the pertinent articles are based on the individual schools' professional features. The thorough practical instruction in mechanical production in Paper 1 [1] also covers process route analysis and development, mechanical analysis, and structural design, in addition to the addition of fixture design based on site visits. The seventh semester should be used to teach the course. The thorough instruction in mechanical manufacturing in Paper 2[2] introduces the Petroleum University "four-in-one" production practice model, which combines the three primary disciplines of process mechanics, process technology, and process control, with the mechanical manufacturing practice and process practice being primarily based on field trips. The comprehensive mechanical manufacturing practical training in Paper 3[3] introduces Changjiang University's perspectives on the development of the mechanical design production practice curriculum system, suggests the general idea of the production practice curriculum system for this major, explains the content and interrelationships of the production practice curriculum, and establishes the structure of the production practice teaching curriculum and the specific assessment. The evaluation of production internship performance of mechanical manufacturing and its automation majors was studied for Paper 4[4]'s comprehensive practical training in mechanical manufacturing. The performance evaluation was broken down into four first-level indicators, and then each first-level indicator was broken down into second-level indicators. Paper 5[5] examines three aspects of enhancing the quality and impact

of students' production internships by strengthening the field infrastructure, enhancing the construction of faculty, and strengthening the process management of students' production internships. It analyzes the current state of production internship in mechanical design and manufacturing and its automation majors. Using the TRIZ theory substance-field model analysis approach, Paper 6[6] investigates the innovation of the production internship model and suggests a creative implementation strategy to raise the standard of production internship. In Paper 7[7], ideas and strategies are put into action for revising the introductory machine building technology course from the standpoint of professional certification.

2. Instructional Program for Comprehensive Machine Manufacturing Practical Training

The comprehensive practical training program in machinery manufacturing at Beijing University of Posts and Telecommunications adopts a trinity of different factory visits (about 60% of total class hours), engineer lectures (about 20% of total class hours), and practical exercises (about 20% of total class hours). Using the professional knowledge acquired to analyze and resolve engineering problems is the main goal of the practical training, which has expanded to include production organization and management, production equipment and production line layout analysis, project management, and comprehensive application, among other topics. The practical training still primarily focuses on the manufacturing process of machinery.

Figure 1 illustrates how this practical activity plays a significant role in the mechanical engineering curriculum system and serves as a link between many other specialized courses such as the foundation of mechanical manufacturing, mechanical principles, mechanical design, industrial robotics, mechanical innovation design, etc., and the previous basic courses such as engineering graphics, theoretical mechanics, material mechanics, engineering materials, etc.

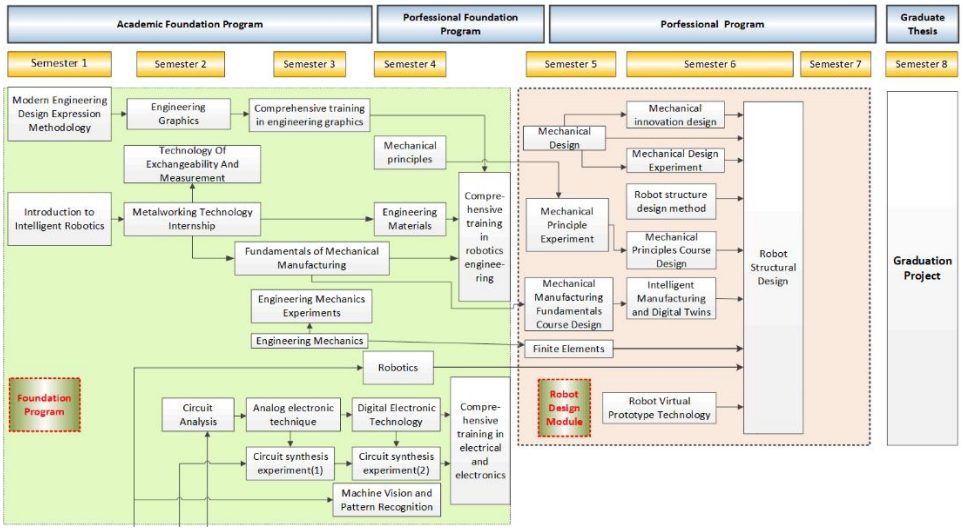


Figure 1. Beijing University of Posts and Telecommunications' Mechanical Engineering Program Chart

In order for the students to understand how the pertinent knowledge is applied in practical engineering and how well it is applied, the course first tests the students' understanding of engineering drawing, theoretical mechanics, material mechanics, engineering materials, and other courses through the problems encountered during the site visit. Second, to set the groundwork for the students to take future courses in fundamental mechanical manufacturing and mechanical design, with an emphasis on helping them comprehend and become accustomed to the normal machining procedures used to create conventional parts. Examples include turning, milling, grinding, drilling and other traditional machining techniques; processing techniques for gears, shafts, boxes, and other common parts; quenching, normalizing, tempering, and other traditional heat treatment techniques; and the assembly of traditional mechanical and electrical products. Thirdly, in order to broaden their horizons, the students will have a better awareness of the traits of various types of electromechanical goods and their production organization techniques. Laying a solid foundation for the study of fundamental mechanical manufacturing, mechanical principles, mechanical design, mechanical innovation design, as well as other professional basic and professional courses, is important. Finally, rigorous organization and management of the internship are required to guarantee its high level of efficiency and safety.

In order to achieve the above-mentioned teaching objectives, the following teaching contents are planned for the comprehensive practical training in mechanical engineering:

1) To evaluate the learning from earlier courses and to comprehend the cognitive information associated with the mechanical profession.

[1]. Method of implementation:

A. Students gain an understanding of the design, production organization, process equipment characteristics of various products in various industries as well as the application of knowledge related to mechanisms, structures, mechanical principles, materials, etc. through a significant number of visits to various types of enterprises. Finally, consider this and make a summary.

B. The relationship and distinction between fixed-point assembly, small batch production assembly, mass production assembly, and the relationship and distinction between single piece production and mass production should all be emphasized to students.

[2]. Internship mode: On-site technicians visit and provide explanations.

Visiting enterprises belonging to different industries and of various types: Drag Research Power (gear processing and testing, mass production), YTO Industrial Park (tractor assembly line including advanced means such as AGV vehicles, mass production), CITIC Heavy Industry (automation workshop, forging workshop, machining workshop, welding workshop, fire-fighting robots, etc., single-piece small batch production), He chai Heavy Industry (diesel engine processing and assembly, single-piece (small batch production), Luoyang LYC bearing (automatic production line, machining workshop, mass production and small batch production), Long Ding Aluminum (aluminum profile production workshop, continuous mass production line), China Railway Equipment (shield machine assembly, single piece production) and many other enterprises (the specific internship may be adjusted according to the enterprise's production off-season).

2) Discover how to machine and assemble common parts, such as gears, boxes, shafts, and other common parts, as well as how to assemble box-type components.

[1]. Implementation mode: a trinity of different factory visits (about 60% of total class hours), engineer lectures (about 20% of total class hours), and practical exercises (about 20% of total class hours).

The lecture of engineer shows how the engineer thinks about a practical engineering problem, and the site visit immediately after the lecture can enhance the learning effect. The visit of the

enterprises. The enterprises to be visited are: Drag Research Power (gear processing, welding), He Chai Heavy Industry (case processing, crankshaft processing, case assembly), Luoyang LYC Bearing (bearing assembly and bearing parts processing), CITIC Heavy Industry (large gear and rotary processing, large parts forging, welding, etc.), China Railway Equipment (shield machine assembly), etc.

3) Recognize how common components are assembled and the assembly procedure involved.

A practical, hands-on methodology must be used in the practical training. Moderately complex disassembly of components or debugging of equipment that requires a certain level of precision, but not beyond the student's ability.

There exist the disassembly and assembly of gasoline engine for small motorcycle, the assembly and debugging of 6-DOF modular robot, mold mapping and other practical operations in this planning. In this way, the safety of practical operation can be ensured while the difficulty of practical operation is also appropriate.

4) Understanding of business management in the machinery industry

Conduct site visits and lectures by business executives, who can be invited to give lectures on various aspects of industrial enterprise organization and management, manufacturing information management and realization.

3. Implementation results

After the above content planning of comprehensive practical training in mechanical engineering, in the implementation process has been widely welcomed by many classes of students, some photos of internship in previous years can show the enthusiasm and seriousness of the students for the internship.

Figure 1. The site explanations of teachers and enterprise engineers and the engineers lectures

Figure 2. The visit for Tractor assembly line and the Shield Machine assembly

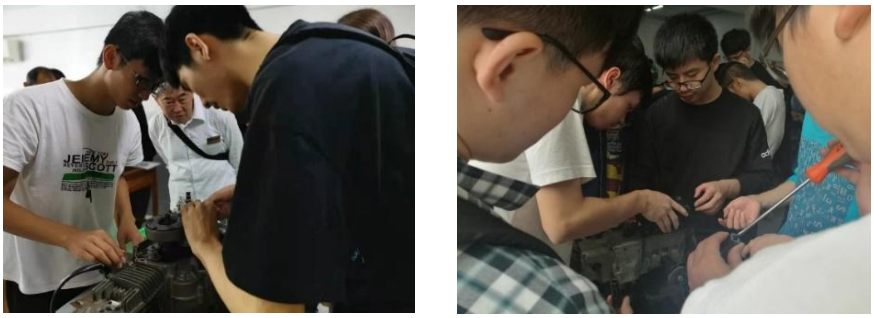
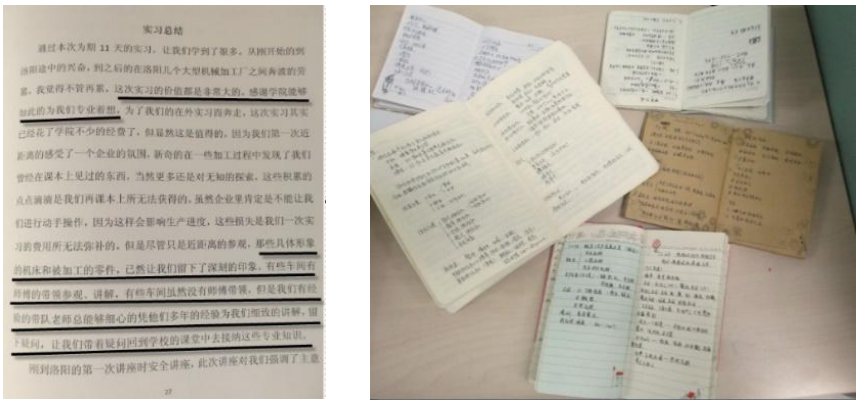


Figure 3. The disassembly and assembly of transmission and engine



实习总结

通过本次为期 11 天的实习，让我们学到了很多。从刚开始的到洛阳途中的兴奋，到之后的在洛阳几个大型机械加工厂之间奔波的劳累。我觉得不管再累，这次实习的价值都是非常大的。感谢学院能够如此的为我们专业着想，为了我们的在外实习而奔走，这次实习其实已经花了学院不少的经费了，但是然这是值得的，因为我们第一次近距离的感受了一个企业的氛围，新奇的在一些加工过程中发现了我们曾经在课本上见过的东西，当然更多还是对无知的探索，这些积累的点点滴滴是我们再课本上所无法获得的，虽然企业里肯定是不能让我们进行动手操作，因为这样会影响生产进度，这些损失是我们一次实习的费用所无法弥补的，但是尽管只是近距离的参观，那些具体形象的机床和被加工的零件，已然让我们留下了深刻的印象。有些车间有详细的带领参观、讲解，有些车间虽然没有师傅带领，但是我们有经验的带队老师总能够细心的凭他们多年的经验为我们细致的讲解，回答疑问，让我们带着疑问回到学校的课堂中去接纳这些专业知识。

刚到洛阳的第一次讲座时安全讲座，此次讲座对我们强调了主意

Figure 4. Some intership summaries from students

5. Acknowledgement

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