



**Design and Fabrication of Transmission Trainer Kit for
Continuously Variable Transmission (CVT) Transmission**



**Bachelor Of Mechanical Engineering Technology (Automotive
Technology) With Honours**

2023



**Faculty of Mechanical and Manufacturing Engineering
Technology**



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Variable Transmission (CVT) Transmission**

Vincent Wong Yew Ming

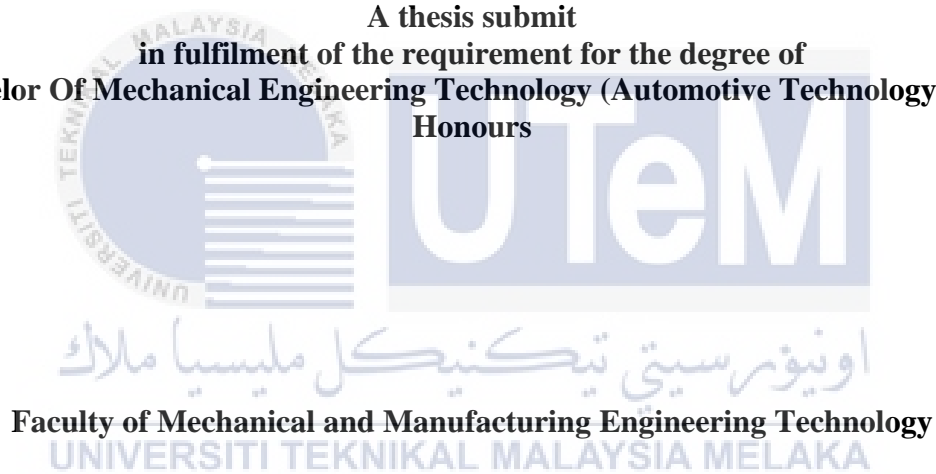
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A thesis submit
**in fulfilment of the requirement for the degree of
Bachelor Of Mechanical Engineering Technology (Automotive Technology) With
Honours**



Faculty of Mechanical and Manufacturing Engineering Technology
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2023

DECLARATION

I declare that this project entitled "**Design and Fabrication of Transmission Trainer Kit for CVT Transmission**" is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature

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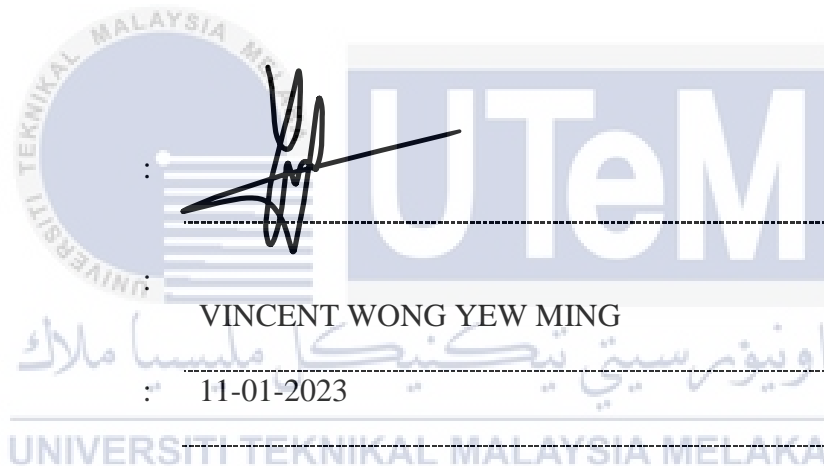
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APPROVAL

I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the Bachelor Of Mechanical Engineering Technology (Automotive Technology) With Honours.

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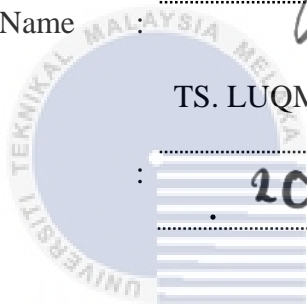


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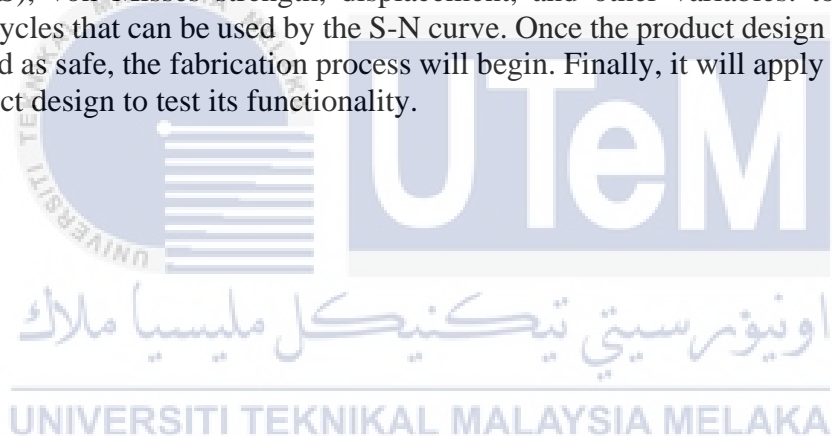
DEDICATION

This work is dedicated with gratitude and sincere appreciation for support, encouragement, and understanding to my supervisor, my cherished mother, father, brothers, and sister, as well as to all my friends, and to all those whose unwavering love, counsel, and support have inspired me to pursue and complete this work.



ABSTRACT

Automotive transmissions are one of the most important components of a vehicle. It is what moves the power from the engine to the wheels. In the faculty's FTKMP automobile laboratory, only manual and automatic transmission training tools are available. According to the questionnaire, automotive students lack the requisite CVT knowledge. Based on the results of the questionnaire survey, 91.1% of the students answered that they needed the CVT training tools to do the hands-on practise for their study purpose. In this case study, it is necessary to design a transmission training stand to hold the CVT transmission. Measure and determine the standards required for product design, to generate design ideas. It will use a Pugh decision matrix table to score the best design for fabricating the product. Choose the suitable materials for the structural design. Because this material has different internal structural designs, it will require the CATIA V6 software to construct 3D components and simulate the strength analysis by the software Altair Inspire to investigate the safety of factors (FOS), von Misses strength, displacement, and other variables. to calculate the number of cycles that can be used by the S-N curve. Once the product design drawings have been verified as safe, the fabrication process will begin. Finally, it will apply the actual load to the product design to test its functionality.



ABSTRAK

Transmisi automotif adalah salah satu komponen terpenting kenderaan. Ia adalah yang menggerakkan kuasa dari enjin ke roda. Di makmal automobil FTKMP fakulti, hanya alat latihan transmisi manual dan automatik disediakan. Menurut soal selidik, pelajar automotif tidak mempunyai pengetahuan CVT yang diperlukan. Berdasarkan hasil tinjauan soal selidik, 91.1% pelajar menjawab bahawa mereka memerlukan alat latihan CVT untuk melakukan latihan amali bagi tujuan pembelajaran mereka. Dalam kajian kes ini, adalah perlu untuk mereka bentuk pendirian latihan penghantaran untuk memegang transmisi CVT. Ukur dan tentukan piawaian yang diperlukan untuk reka bentuk produk, untuk menjana idea reka bentuk. Ia akan menggunakan jadual matriks keputusan Pugh untuk menjaringkan reka bentuk terbaik untuk fabrikasi produk. Pilih bahan yang sesuai untuk reka bentuk struktur. Oleh kerana bahan ini mempunyai reka bentuk struktur dalaman yang berbeza, ia memerlukan perisian CATIA V5R21 untuk membina komponen 3D dan mensimulasikan analisis kekuatan oleh perisian Altair Inspire untuk menyiasat keselamatan faktor (FOS), kekuatan von Mises, anjakan dan pembolehubah lain. Untuk mengira bilangan kitaran yang boleh digunakan oleh keluk S-N. Setelah lukisan reka bentuk produk telah disahkan sebagai selamat, proses fabrikasi akan bermula. Akhir sekali, ia akan menggunakan beban sebenar pada reka bentuk produk untuk menguji kefungsiannya.



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LIST OF SYMBOLS AND ABBREVIATIONS

CVT	-	Continuously Variable Transmission
FTKMP	-	Faculty of Mechanical and Manufacturing Engineering Technology
FOS	-	Factor Of Safety
HOQ	-	House of Quality
IVT	-	Infinitely Variable Transmission
MTUN	-	Malaysian Technical University Network
PDS	-	Product Design Specification
VDP	-	Variable-Diameter Pulley
TVET	-	Technical and Vocational Education and Training
UTEM	-	Universiti Teknikal Malaysia Melaka
TCT	-	Tungsten Carbide Tips



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CHAPTER 1

INTRODUCTION

1.1 Background

This thesis aims to develop a missing practice tool in my faculty of Mechanical and Manufacturing Engineering Technology (FTKMP) used for Automotive Students. University Technical Malaysia Malacca (UTeM) is one of the technical universities belonging to the Malaysian Technical University Network (MTUN) (*History Of UTeM, 2000*), developing our career-focused education. UTeM education is half theory-based and half practical (*Malaysia Education Ministry Targets Increasing TVET Enrolment to 650,000 Students by 2025, 2015*). Practical lessons allow the student to understand better the machinery learned in theory lessons. Due to the laboratory's lack of Continuously Variable Transmission (CVT) Trainer Kit, automotive students are unable to gain hands-on experience. This case study will create the most suitable design for this project and fabricate the CVT training kit for educational purposes. The 3D design drawing will use the Dassault System CATIA V6 software and the simulation process will use an Altair Inspire software to determine the strength analysis. The simulation will ensure the supported weight of the manufactured product can reach the actual safety range to provide safe education tools in the students' practical sessions.

1.2 Problem Statement

FTKMP currently does not have a continuously variable transmission (CVT) training kit for educational demonstrations. The Vehicle Trainer Kit is a training and teaching tool that helps students better grasp the topics they are studying in the classroom, especially in the field of automotive engineering. A questionnaire will test students' knowledge regarding the basic theory of continuously variable transmissions (CVTs). The result shows that the third and fourth-year automotive students still have limited transmission learning mechanisms. They still cannot understand the CVT transmission system, interior parts, and function.

Figure 1.1 shows that 90.9% of the students need a CVT trainer kit for educational purposes to help them do practical learning in their lab section. This survey can justify that automotive students need the training kit for their hands-on practice sessions to understand the overall components and function better.

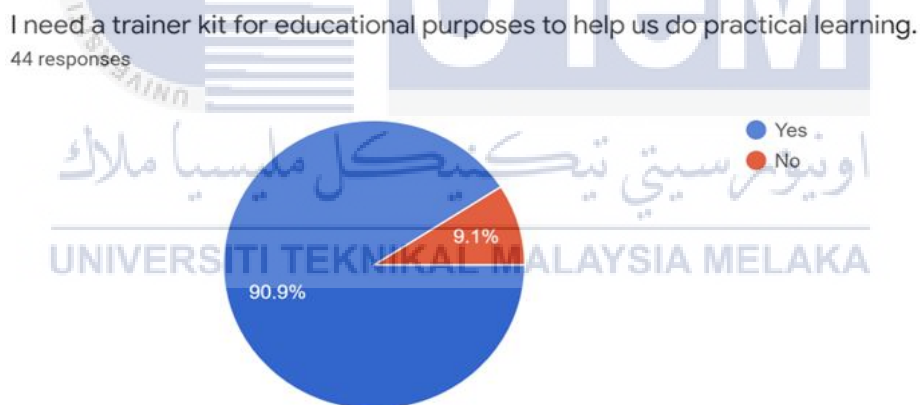


Figure 1.1 Survey for the Required Trainer Kit

Do you believe that by doing stuff hands-on will help you understanding better?
45 responses

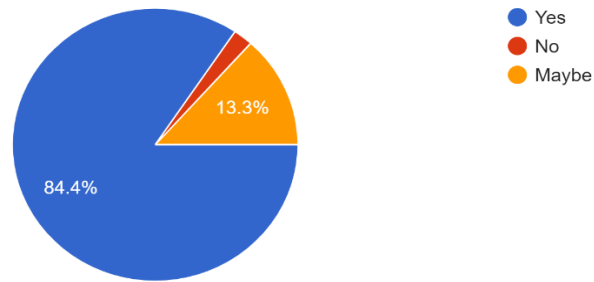


Figure 1.2 Hands-on tools will improve knowledge.

Figure 1.2 shows that most respondents answered yes that the hands-on training kit would improve their knowledge 84.4% of them. The evaluated survey form shows the knowledge of CVT transmission is quite limited to automotive students in UTeM because students only have some knowledge learned from the theory part and can't correctly answer the questions in my questionnaire. FTKMP workshop currently lacks the CVT trainer kit for education practice which affects students who can't understand the CVT transmission working principle. Students are unable to connect academic concepts to practical applications. Therefore, CVT Stand must be developed to install the CVT transmission better for the instructor to teach automotive students during the lab section.

1.3 Research Objective

Based on the background and problem statement given above. This project aims to be able to design and fabricate a product to fix the current issues in our faculty. The objectives are as follows:

- a) To fabricate a CVT trainer kit to assist students in gaining knowledge through hands-on practice.
- b) To design and analyse a CVT support stand for structural durability using Catia V6 and Altair Inspire.

1.4 Scope of Research

This project will focus on developing a Continuously Variable Transmission (CVT) training kit stand used in the automotive workshop in UTeM. They have the following scope:

- This project design is limited only to automotive technology engineering students at UTeM.
- Develop the concept design based on the respondent's criteria and questionnaire feedback.
- Analyse the structural CVT trainer stand using the Generative Structure Analysis process to determine its strength.
- This project will conduct the manufacturing process of cutting, drilling, welding, and assembling to create the product at the target cost.
- The analysis will only be structural analysis to determine the strength and durability of static and torque loading.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The literature review aims to review other research related to the study design and fabrication of a Transmission Trainer Kit for educational purposes (CVT Transmission) with the advantage of learning through hands-on applications and comparing it to a theory-based study. This study also uses this literature review to determine the problem statement, the best solution, and the most appropriate methodology. The Fourth Industrial Revolution (IR 4.0) will change how people live, work, communicate, and value things in the future. Shifts in current business models and employment trends. The value of data and information to humanity, now and in the future, is undeniable, and Malaysia needs a skilled workforce to meet the demands of Industry 4.0. Under such circumstances, industry companies must be more responsive and not lag behind cyber-physical systems incorporating new functions and cutting-edge technologies. These factors should be mobilised by high-quality talents, especially in developing artificial intelligence and large-scale data analysis methods such as applications and services. According to Trend researchers, IR 4.0 will require significant changes in culture, delivery, pedagogy, and structure. Education 4.0 must be able to produce highly creative graduates with critical thinking skills. Graduates must be creative and entrepreneurial, with the cognitive flexibility to respond to various situations.