



UNIVERSITI TEKNOLOGI MARA
CAWANGAN JOHOR

MEC300

**DESIGN, ANALYSIS AND
FABRICATION OF HYDRAULIC JACK**

AMMAR BIN AZMAN

2019428568

Dissertation submitted in partial fulfillment
of the requirements for the degree of

Diploma
(Mechanical Engineering)

College of Engineering

March 2022

ABSTRACT

The invention of a hydraulic jack started as early as in the 17th century, and it has gone through lots of remarkable improvements. This product plays a very important role in everyday life especially for car owners. A hydraulic jack is a device used to lift heavy load or objects, thus allowing users to proceed with their further actions. A classic example is during replacing car tires that requires to lift up the vehicle. Nowadays, there are a lot of complaints regarding a hydraulic jack being too heavy and big, making it difficult to handle. So, this project intends to produce a simple hydraulic jack that is compact, lightweight, and portable, as well as being affordable.

Hence, this project outlines the design, analysis, and fabrication of this hydraulic jack by undergoing several steps that include conducting a survey, brainstorming, and sketching several design concepts, embodiment design phase of the selected concept, and finally its fabrication with the desired measurement and specification. The hydraulic jack ultimately aims to provide a better and more user-friendly hydraulic jack that can be used by everybody with minimal difficulties due to the product being compact, lightweight, and portable.

ACKNOWLEDGMENT

First of all, I would like to express my deepest appreciation to my lecturer, Dr. Suhadiyana Binti Hanapi who has given me the guidance and advice in order for me to complete this interesting project.

Special thanks as well to Uncle Sam for highlighting the difficulties faced by Felda Gedangsa community in Selangor.

Also, thank you to my family especially to my father and brother for helping and introducing to me about the importance of hydraulic technology in daily context.

I also would like to acknowledge my appreciation to my friends who were involved directly and indirectly in helping me to finish this project by providing some knowledge, experience and participating in my survey to support my findings.

Last but not least, I am very thankful to my family for the never-ending-support towards my ambition and interests in mechanical engineering.

TABLE OF CONTENTS

Chapter 1 – Introduction	7
1.0 Overview / Background of the Project	7
1.1 Problem Statement	8
1.2 Design Objective	9
1.3 Scope of Project	10
1.4 Significance of the Project / Customer Requirement	11
1.5 Expected Result	13
Chapter 2- Literature Review/ Problem Definition	14
2.0 Information on existing products, patents, standards	14
2.1 Product design specification based on literature review	19
Chapter 3-Methodology	21
3.1 Concept design	22
3.2 Concept design sketch	24
3.3 Selected design in CAD software, assembly drawing.	31
3.4 Finalized design in CAD software, assembly drawing	38
3.5 Engineering Calculation	50
3.6 Engineering Analysis	51
3.7 Cost Calculation for the Product	54
3.8 Manufacturing / Fabrication Detail	59
3.9 Final fabricated working prototype	71
Chapter 4-Results and Discussion	73
4.1 Introduction	73
4.2 Testing working product capability	74
4.2.1 Operation time to complete the task	74
4.2.2 Product specification or capabilities	75
4.3 Product advantages and limitation	78
4.3.1 Advantages of the product	78
4.3.2 Limitation of the product	79
4.4 Product manual operation	80

CHAPTER 1 - INTRODUCTION

1.0 Overview / background of the project

In this semester, Mechanical Engineering Students are needed to innovate and prepare a project or prototype based on any theme as it is suitable for diploma level. The project title for this FYP project that is “Design, Analysis and Fabrication of Hydraulic Jack”. The product is intended to produce a better hydraulic jack based on the customer responses and to fulfill their requirement.

The first step in designing a product is to find a suitable problem that people face that needs to use a hydraulic jack. Hence, the first step is to make a survey to get the respondent’s feedback on what features do they want and need in a hydraulic jack. This will ensure that the product will be useful to the people as the hydraulic jack will be based on people’s opinions and needs.

The next step is sketching and brainstorming on possible ideas on what materials to use and design of the hydraulic jack. From the ideas produced, several sketches have been made and only the best and suitable design will be used.

Then, the final design that is chosen will undergo the embodiment design phase where the chosen sketch is drawn in more detail and given rough dimensions. The list of components of the project will also be listed to get an overview of what item need to be used and bought, and what specific components are needed to fabricate. The cost of the material will be recorded to get an early view of the total cost of the project. After that, the three-dimensional (3D) model of the prototype will be constructed using the Solidworks 2017 software. Then a simple stress simulation is conducted to test the feasibility of the design. The fabrication takes place to produce the prototype with the desired measurement and specification. The prototype is then assembled according to designed model.

Finally, after the completion of the prototype, the test of prototype is conducted to see if the prototype functions as the way it is intended to be and whether it is safe to be used. The list of drawbacks, strengths and recommendation are also listed for future improvements.