



MONITORING MAINTENANCE OF MOTORCYCLE SERVICING SCHEDULE



**BACHELOR OF MECHANICAL ENGINEERING TECHNOLOGY
(MAINTENANCE TECHNOLOGY) WITH HONOURS**

2023



**Faculty of Mechanical and Manufacturing Engineering
Technology**



**MONITORING MAINTENANCE OF MOTORCYCLE SERVICING
SCHEDULE**

Zul Hairi Bin Abdul Aziz

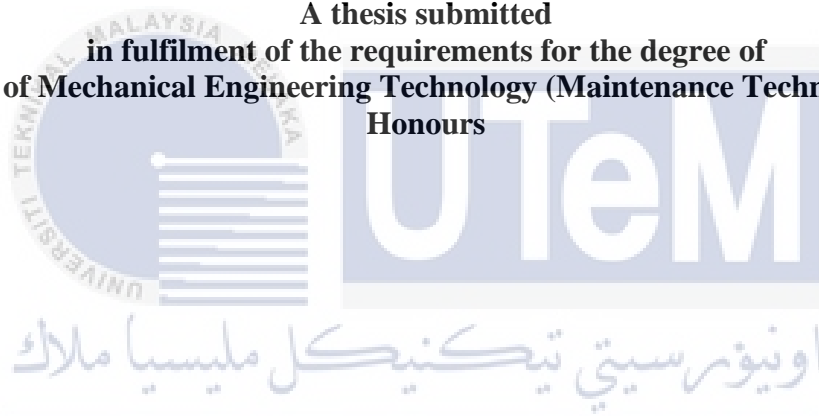
**Bachelor of Mechanical Engineering Technology (Maintenance Technology) with
Honours**

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MONITORING MAINTENANCE OF MOTORCYCLE SERVICING SCHEDULE

ZUL HAIRI BIN ABDUL AZIZ

A thesis submitted
in fulfilment of the requirements for the degree of
**Bachelor of Mechanical Engineering Technology (Maintenance Technology) with
Honours**



Faculty of Mechanical and Manufacturing Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2023

DECLARATION

I declare that this thesis entitled “Monitoring Maintenance of Motorcycle Servicing Schedule” is the result of my own research except as cited in the references. The “Monitoring Maintenance of Motorcycle Servicing Schedule” has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature

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Date


: 3/01/2023

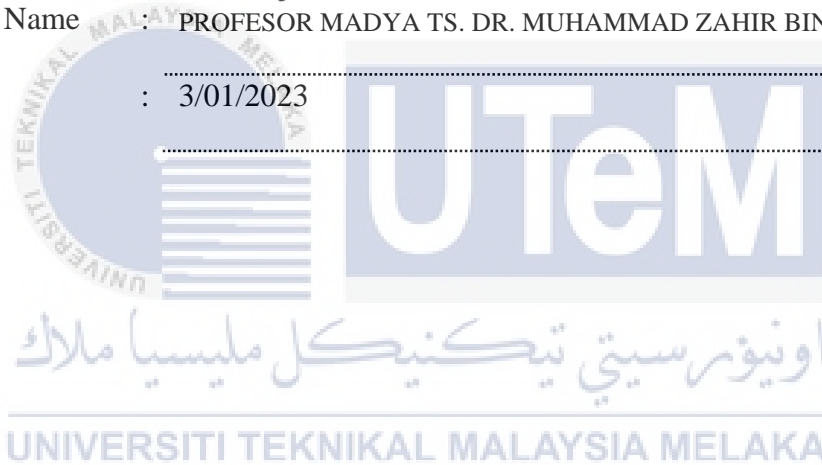
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APPROVAL

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 (Maintenance Technology) with Honours.

Signature : 
Supervisor Name : PROFESOR MADYA TS. DR. MUHAMMAD ZAHIR BIN HASSAN
Date : 3/01/2023



DEDICATION

This dissertation is dedicated to my beloved parents Abdul Aziz Wahab, and Suzana Mohammed, my family, and my friends whose unyielding love, support, and encouragement have enhanced my soul and inspired me to pursue and complete this research.



ABSTRACT

Motorcycle engine system has been a major concern in servicing issues to maintain the engine performance of a motorcycle. The focus of this thesis is to investigate the servicing schedule for motorcycle engines system by using the design of experiments (DOE) method in the static instability of a motorcycle engine parts leading to their performance. A present methodology is introduced in which monitoring maintenance on engine oil, oil filter, and the battery is performed to monitor the viscosity index, elemental analysis, battery voltages, effect of oil filter and influence on performance within the engine system in the Yamaha Y15ZR. The experimental study yields findings on viscosity index, elemental data, condition of oil filter, and the difference on battery voltage. The study of the viscosity index and elemental analysis of engine oil is investigated to differentiate the degradation of viscosity on certain mileage and to detect the presence of destructive contaminant inside the engine system since the viscosity and contaminant influence the performance of the motorcycle engine system. An experimental investigation through observation is also carried out to determine the condition of the oil filter, and battery which leads to a validation of the results. The 150 ml sample is taken for oil before being tested in the laboratory for viscosity index and elemental results. Parametric settings on the changing engine oil and oil filter determine the performance of each of these factors in the engine system. The approach can be used as a reference to evaluate the distance needed before degradation happens. Maintenance schedule was created after the data was analyzed for each of the sample.

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ABSTRAK

Sistem enjin motosikal telah menjadi kebimbangan utama dalam isu servis untuk mengekalkan prestasi enjin motosikal. Fokus tesis ini adalah untuk menyiasat jadual servis bagi sistem enjin motosikal dengan menggunakan kaedah reka bentuk eksperimen (JAS) dalam ketidakstabilan statik bahagian enjin motosikal yang membawa kepada prestasinya. Metodologi semasa diperkenalkan di mana pemantauan penyelenggaraan minyak enjin, penapis minyak dan bateri dilakukan untuk memantau indeks kelikatan, analisis unsur, voltan bateri, kesan penapis minyak dan pengaruh ke atas prestasi dalam sistem enjin dalam Yamaha Y15ZR. Kajian eksperimen menghasilkan penemuan mengenai indeks kelikatan, data unsur, keadaan penapis minyak, dan perbezaan voltan bateri. Kajian indeks kelikatan dan analisis unsur minyak disiasat untuk membezakan kemerosotan kelikatan pada perbatuan tertentu dan untuk mengesan kehadiran bahan cemar yang merosakkan di dalam sistem enjin kerana kelikatan dan bahan cemar mempengaruhi prestasi sistem enjin motosikal. Penyiasatan eksperimen melalui pemerhatian juga dijalankan untuk menentukan keadaan penapis minyak, dan bateri yang membawa kepada pengesanan keputusan. Sampel 150 ml diambil untuk minyak enjin sebelum diuji di makmal untuk indeks kelikatan dan keputusan unsur. Tetapan parametrik pada penukaran minyak enjin dan penapis minyak menentukan prestasi setiap faktor ini dalam sistem enjin. Pendekatan tersebut boleh digunakan sebagai rujukan untuk menilai jarak yang diperlukan sebelum degradasi berlaku. Jadual penyelenggaraan dibuat selepas data dianalisis untuk setiap satu sampel.

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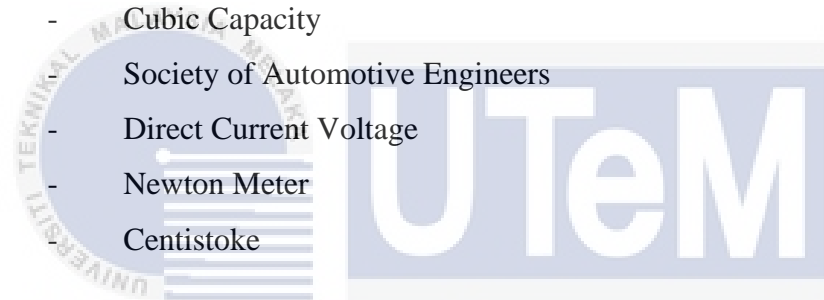
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LIST OF SYMBOLS AND ABBREVIATIONS

km	-	Kilometres
ASTM	-	American Society for Testing and Materials
ml	-	Millilitre
ECU	-	Electronic Control Unit
BDP I	-	Bachelor's Degree Project I
BDP II	-	Bachelor's Degree Project II
RDEAES	-	Rotating Disc Electrode Atomic Emission Spectrometer
VRLA	-	Valve Regulated Lead-Acid
cc	-	Cubic Capacity
SAE	-	Society of Automotive Engineers
DCV	-	Direct Current Voltage
N.m	-	Newton Meter
cSt	-	Centistoke



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CHAPTER 1

INTRODUCTION

1.1 Overview

A motorcycle is mostly known as a two-wheel motor vehicle that has the same concept as a bicycle unless it is effortless because the motorcycle is using an engine to move. In the 19th Century, the three-wheeled motorcycle design was first introduced by Edward Butler, which produced a gasoline engine that was mounted between two steerable front wheels by using a drive chain to the rear wheel (Cromer, 2020). Gottlieb Daimler and Wilhelm Maybach made the Daimler Reitwagen as shown in **Figure 1.1** which was the first internal combustion of petroleum-fueled motorcycle back in 1885 in Germany (Stkone, 2011). Scientists back in the 19th Century believed that combining steam engines and the concept of the bicycle could improve the flow of transport on public roads.

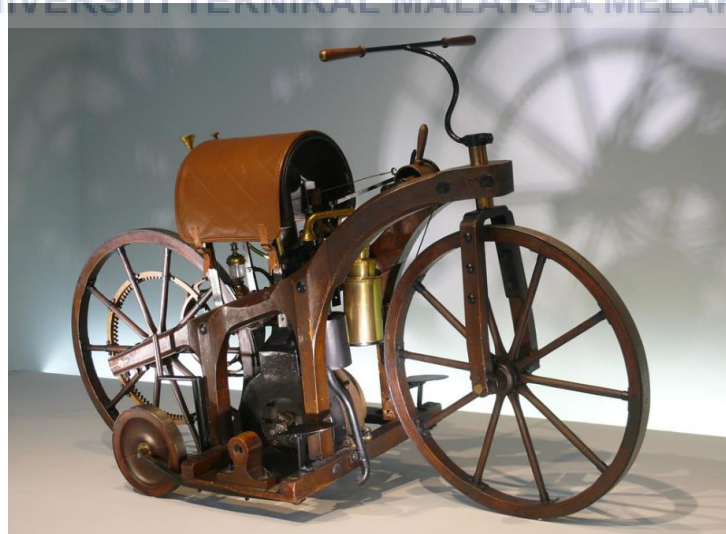


Figure 1.1 Daimler Reiwagen Replica

(Source: Stkone, 2011)

There are two variations of the engine which are 4-stroke and 2-stroke. The major difference between the two engines is that 4-stroke engines have to go through four phases or two complete rotations. For example, the piston needs to move from the top center to the bottom of the cylinder and during the combustion cycle, the piston captures air and gas when it reaches the bottom of the cylinder. **Figure 1.2** shows the 4-stroke working principle diagram (Goel, 2021). When the piston moves back to the top, the exhaust valve is used to expel the exhaust. **Figure 1.3** shows the 2-stroke working principal diagram where it goes through 2 stages or one complete revolution. It works by combining more functions into one piston movement (Cameron, 2015). During upstroke (ignition/compression), the fuel will enter the crankcase when the piston goes up. Then the fuel-air mixture is getting compressed and ignited by the spark plug. While during the downstroke (power/exhaust), the piston will be pushed to the bottom of the cylinder once the fuel is ignited and the exhaust is expelled (Dumitrache, 2010)

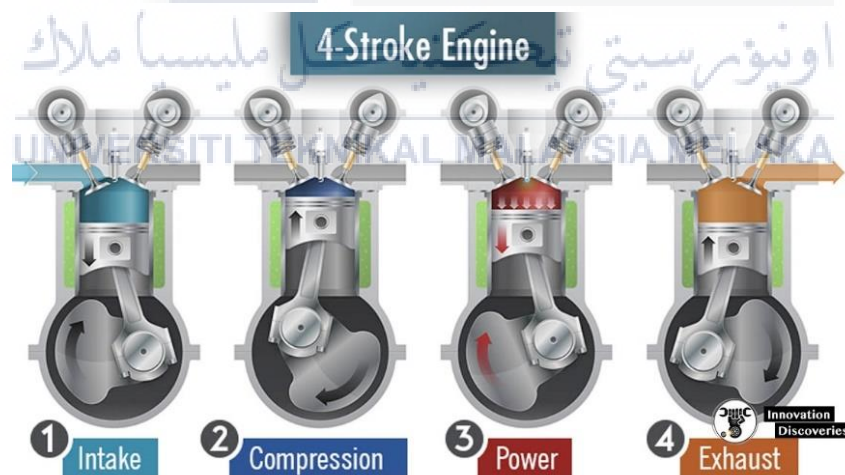


Figure 1.2 4-stroke working principle diagram

(Source: Goel, 2021)

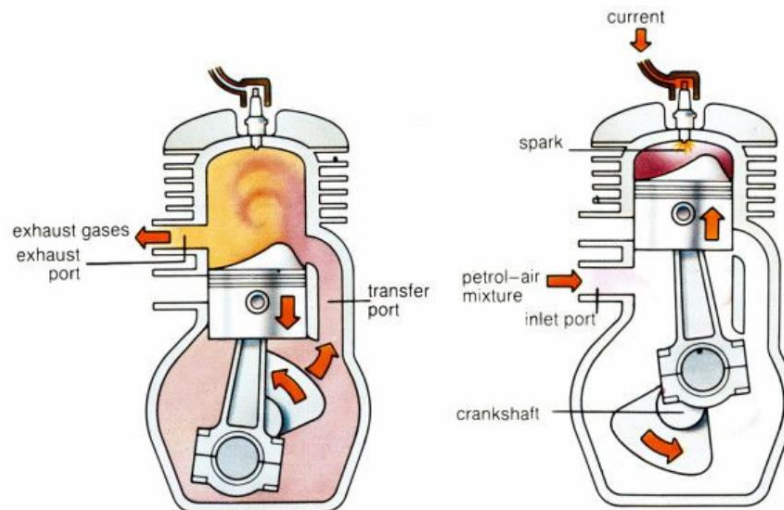


Figure 1.3 2-Stroke Working Principal

(Source: Cameron, 2015)

In general, many parts play a big role to maintain the engine performance such as engine oil, spark plug, oil filter, battery as well as coolant. These parts are classified according to the manufacturer's guideline manual book. For example, the voltage of the battery needs to be checked every 3000 km and a change is required if the battery has a low voltage on it that will indicate dropping in engine performance and also other accessories such as meter and ignition performance (Yamaha, 2019). This was confirmed by Li *et al.* (2010) who state that ignition timing will affect the performance of an engine.

Therefore, by maintaining the engine of a motorcycle is crucial for safety and keeping it in top working condition. Regular and proper engine maintenance will help keep the engine functioning for an extended amount of time. Monitoring maintenance can help avoid unnecessary repairs, which will increase the amount of money spent. The manual from manufacturers must be followed to maintain the engine performance for a long period.

1.2 Problem Statement

As the motorcycle market in Malaysia is expected to maintain its robust growth, making it to the second most popular mode of transport in the country after car. Many of them use motorcycle as a main transportation to go working mainly because of the traffic jams. The concerning about the maintenance of motorcycle always been an issue to the motorcyclists as they don't know the exact time or distances to do the maintenance for some parts such as engine oil. Most of the repair shops usually recommended 3000 km-5000 km interval based on the different brand and viscosity to replace the engine oil. Although some of the distributor comes with a guideline for a proper maintenance on engine oil, there are not always fit onto the motorcycle as different brand of motorcycle has their own different lifetime of parts.

Furthermore, there are various parts that need to be maintained to preserve its lifespan. Due to this problem, most of the motorcyclists usually take measures to just waiting for the parts to be damaged or until the motorcycle breakdown. This way, the cost to do replacement or maintenance usually will be higher and the time to repair increase. This will affect daily routine of the motorcyclists if their using it as main transportation. Thus, the study for monitoring maintenance of motorcycle to find suitable servicing schedule for some parts related to engines will benefits motorcyclists who suffer from maintaining their motorcycle in good condition.

1.3 Research Background

The engine is functioning as the mechanism to transform the energy from combustion fuel-air to work (Turns, 1996). Due to this operation of the engine, it helps the motorcycle to move with the help of the other's rotary parts and gears. This project focuses on the analysis performance of engine motorcycle by measuring the viscosity index, elemental analysis of engine oil, also monitoring the condition of other parts that involved with the engine. The experiment will be done by taking the reading of viscosity index and elemental analysis of engine oil, and observed the condition of oil filter and battery after a certain distance is achieved. The maintenance schedule will be developed after the data was analyzed.

However, investigation of the servicing schedule due to engine motorcycle variable operating condition is limited which mostly examined engine oil, oil filter and battery.

1.4 Research Objective

The main aim of this research is to investigate the servicing schedule on engine motorcycles by using the design of experiments (DOE) method. Specifically, the objectives are as follows:

- a) To investigate the viscosity index and elemental analysis of engine oil using viscometer and rotating disc electrode atomic emission spectrometer machine.
- b) To observe the effect of oil filter and battery on engine performance after a certain distance.
- c) To determine the mileage servicing scheduled towards preventive performance engines of a motorcycle.

1.5 Scope of Research

To specify the tasks for this study, the experiment of the oil analysis is conducted in the laboratory UTeM facility using the Kittiwake Heated Viscometer to gain the reading of viscosity index and elemental analysis is done using Rotating Disc Electrode Atomic Emission Spectrometer (RDEAES) to gain the contaminant data. The oil filter and battery were also goes through the experiment to elucidate their effect on the engine motorcycle after a certain distance. This research is performed by using Yamaha 150ZR V1 2019 model. The main test of oil analysis will conduct with 4 different oils for every 1000 km distances then the result will be recorded. For the oil filter and battery will be inspected also every 1000 km to gain better information on the performance of the engine. By performing this maintenance, it will reduce the cost of exchanging the parts that are still useful and at once maintaining the performance of the engine motorcycle.

1.6 Expected Result

The monitoring maintenance of the motorcycle servicing schedule is expected to:

- a) Helping to determine the exact distance needed before the engine parts performance drop.
- b) Reduce the cost of the part that need to replace.
- c) Analysis of the performance of the engine after maintenance.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The subject of monitoring maintenance motorcycles on engine performance servicing schedules has generated a considerable volume of literature which includes a number of theories that have been formulated to explain the mechanism of monitoring maintenance of motorcycle engine systems. Studies on the monitoring maintenance of motorcycle engine systems involve two major areas of study: performance engine and servicing schedule.

This chapter begins with an introduction to the motorcycle engine system, to give an overview of the engine parts and their functions. The distinct categories of motorcycle engine performance are presented according to the parts in which they occur. A review of motorcycle engine system literature is then presented that explains the performance of motorcycle engines under the servicing scheduled maintenance. The scientific findings are categorized into simulation and experimental approaches to achieve and analyze the motorcycle engine performance. The subsequent section discusses experimental investigations that have been employed to tackle the motorcycle engine problems. Finally, motorcycle engines under the servicing scheduled maintenance research review paper and summary of existing approaches are provided together with their limitation for solving the motorcycle engine issues. The structure of the chapter is shown in **Figure 2.1**.

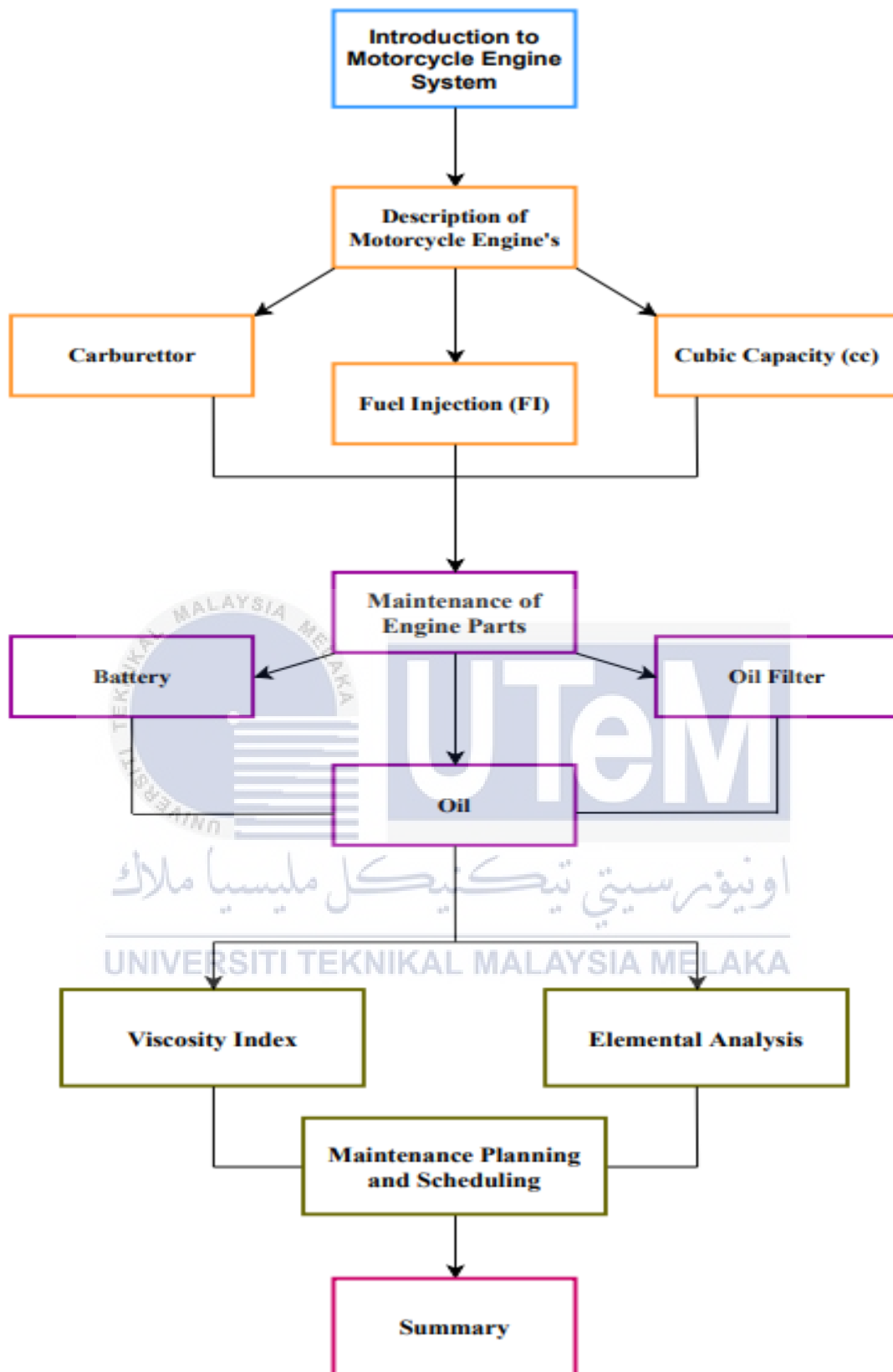


Figure 2.1 Overview of Literature Review