

**SELECTION OF ENGINE PARTS AND
ASSEMBLY OF MODEL SYSTEMS FOR
TEACHING PURPOSES
(INCLUDING VISUAL AIDS)**

By

THEODOROS DIMITRIOU

Project Report submitted to the

**Department of Mechanical Engineering
Of the HIGHER TECHNICAL INSTITUTE
Nicosia, Cyprus**

**In partial fulfilment of the requirements for the Diploma of
TECHNICIAN ENGINEER**

In

MECHANICAL ENGINEERING

Project Number: M - 1052

**Project Supervisor: Dr. Lazaros Lazaris
Lecturer in Mechanical Engineering**

June 2009

HIGHER TECHNICAL INSTITUTE	PROJECT NO 3828
----------------------------------	--------------------

ACKNOWLEDGEMENTS

I wish to express my deep appreciation to a number of people for their valuable help for the completion of this project.

I am greatly indebted to my project supervisor, Dr. Lazaros Lazaris who was always on my side, encouraging, and advising me from the beginning of this project to its completion. It would be a great omission not to express my sincere gratitude to my tutors at the H.T.I for all the help and support during my studies at the Higher Technical Institute.

I would also like to express my thanks to my fellow-students for their help and assistance in finding and acquiring the two engine models needed for the practical part of my project work.

Special thanks to “Elysee Irrigations LTD” for their assistance in making the necessary sections on the two-stroke engine, in their workshop, during my industrial training module. I want to express my thanks Mr. Andreas Chimaris, for his assistance during my work project. I would also like to express my thanks to Mr. Andreas Varnava who helped me to prepare the four-stroke engine in his workshop.

Finally, I would like to express my love and thanks to my family for their encouragement and moral support the whole time I was working on the project.

I dedicate this project to my family for its support and love

THEODOROS DIMITRIOU

JUNE, 2009

NICOSIA, CYPRUS

~~Theodoros Dimitriou~~

SUMMARY

The objective of this project is to describe how internal combustion engines work and what parts and systems comprising an internal combustion engine. What is the function of all the engine parts, and how they are assembled together, variations of most commonly known engines, what systems and peripheral components are used to construct a functional engine are discussed in this project in the simplest possible way.

Note that for better understanding of the topic a survey of multiple basic components, and systems have been incorporated in the project. Emphasis is given to modern technologies regarding these components and systems, although the basic concept is explained using the older components and systems. Pictures and videos are used throughout the project in order to identify the components and systems and become familiar with the basic operation of internal combustion engines. The videos are provided in a mini DVD attached at the back-cover of the project. Note also that certain models of a two-stroke engine (Suzuki FM50) and a four-stroke engine (Honda CF50) have been sectioned and prepared as training models such that the trainees can visualise the internal components of an engine and how they function together as an engine. These two models have been prepared to be used in Automotive Technology training programmes.

Finally detailed drawings of the two-stroke engine components, as well as assembly drawings of the two-stroke engine are shown. The drawings were constructed using the CAD Software “Siemens UGS NX6”, and with the aid of “AutoCAD 2008” as well.

CONTENTS

<u>Title Of Section</u>	<u>Page</u>
ACKNOWLEDGMENTS	2
SUMMARY	3
CONTENTS	4
INTRODUCTION	6
CHAPTER 1: CLASSIFICATION AND LAYOUT OF ENGINES	8
1.1 Classification depending of the fuel used	8
1.2 Classification depending of the engine's cycle	8
1.3 Layout of engines	8
CHAPTER 2: MAIN COMPONENTS AND THEIR FUNCTION	10
2.1 Cylinder Block and Crankcase	10
2.2 Piston and Piston Rings	12
2.3 Connecting Rod	15
2.4 Crankshaft	17
2.5 Inlet and Outlet Valves	19
2.6 Camshaft	21
2.6.1 Push Rod Camshaft Arrangement	23
2.6.2 Overhead Camshaft Arrangement	24
2.7 Flywheel	25
2.8 Engine Assembly	26
CHAPTER 3: OPERATION CYCLES OF ENGINES	29
3.1 Four-Stroke Cycle	29
3.1.1 Four-Stroke Petrol Engine Cycle	29
3.1.2 Four-Stroke Diesel Engine Cycle	33
3.2 Two-Stroke Cycle	34
3.2.1 Two-Stroke Petrol Engine Cycle	34
3.2.2 Two-Stroke Diesel Engine Cycle	36
3.3 Four-Stroke vs. Two-Stroke Engines	39
CHAPTER 4: ENGINE SYSTEMS AND PERIPHERALS	41
4.1 The Cooling System	41
4.2 The Lubrication System	46

<u>4.3</u> The Fuel System.....	48
<u>4.4</u> The Ignition System.....	55
<u>4.5</u> The Clutch System.....	59
<u>4.6</u> The Braking System.....	63
<u>CHAPTER 5: VISUAL AIDS OF ENGINES</u>.....	69
<u>5.1</u> Suzuki FM50	69
<u>5.2</u> Honda CF50.....	72
LIST OF USEFUL TECHNICAL TERMS.....	74
CONCLUSION.....	76
REFERENCES	78
APPENDIX.....	80

INTRODUCTION

Heat Engines can be classified as of the external combustion type or the internal combustion type. In an external combustion type engine, the working fluid, which is producing power, is entirely separated from the fuel-air mixture, the heat of combustion being transferred through the walls of a containing vessel or a boiler. Examples of this type are the steam engine, and the closed-cycle gas turbine.

In internal combustion engines the working fluid producing power consists of the products of combustion of the fuel-air mixture itself. This type includes the reciprocating or rotary (Wankel) petrol or diesel engine, and the open-cycle gas turbine.

This project is mainly concerned with the reciprocating piston type, which is the most widely used one, so the term internal combustion engine will denote the reciprocating piston type for the rest of the project.

The internal combustion engine has the lowest ratio of power-plant weight to maximum output and is used extensively in the field of transportation. Today the manufacture of internal combustion engines for automobiles, boats, ships, airplanes, trains and small industrial power units is one of the largest industries in the world.

But how internal combustion engines work? What are the main parts of an engine, and how they are assembled together making an engine to produce power?

Basically an internal combustion engine consists of:

1. A number of cylinders depending on the engine layout, which are tubes of circular cross section, closed at one end known as cylinder block or monoblock.
2. Pistons, which fit closely inside the cylinder, sliding up and down.
3. Connecting rod, to connect the piston to the crankshaft.
4. Crankshaft, which is the main shaft of the engine and is carried in bearings in the crankcase.
5. Camshaft to control when the valves open and close to control the flow of air-fuel mixture and the exhaust gases.

6. Valves to control the flow of gases into and out the cylinder.
7. A flywheel to smooth out the engine's pulses by using its inertia to store energy.
8. A lubrication system to provide lubrication to the moving parts of the internal combustion engine.
9. A cooling system to maintain a steady temperature for the engine and avoid overheating the engine.
10. A fuel system to provide the necessary fuel quantity when needed.
11. An ignition system is also necessary in petrol engines, to control the firing order of the engine at the right time.
12. A clutch system to transmit torque and power to the gearbox when needed.

The braking system of a vehicle, which slows down or stop the vehicle when needed will also be explained as is one of the Diploma Project's objectives.