

**DEVELOPMENT AND FABRICATION
OF IGNITOR CIRCUIT FOR
PORTABLE LASER CUTTING MACHINE**

**This thesis is presented in partial fulfilment for the award of the
Bachelor of Electrical Engineering (Hons) of
MARA INSTITUTE OF TECHNOLOGY**



**ROHAYU BT. MUHAMAD ZAIN
Faculty of Electrical Engineering
MARA Institute of Technology
40450 Shah Alam
APRIL 1998**

ACKNOWLEDGEMENT

In the name of ALLAH, the Beneficent, the Merciful. It is with the deepest sense of gratitude to ALLAH for given me the strength, ability and patient in completing the project.

Many people good contributed their precious time, gave freely of their invaluable advice, in one manner or other, helped and collaborated with us towards preparing and the accomplishment of this project.

I would like to take this golden opportunity to express my most appreciation and heartfelt gratitude to Encik **NGAH RAMZI HAMZAH** as my project advisor for his guidance, encouragement and help from beginning up to the end of the project.

I also would like to express my special gratitude to my family for their inspiration and invaluable support along the duration of my studies until this thesis is completed. Last but not least, my special thanks to all friends and many others who some other, direct or indirectly contributed to the success of the project.

ABSTRACT

This thesis describes the development and fabrication of an Ignitor Circuit Module. This circuit is meant to produce high voltage pulses. This circuit is a part of the Portable Laser Cutting Machine project. Ruby laser is employed because of its robustness. The ignitor circuit inject pulses in addition to the capacitor banks. This will create a sufficient voltage for the laser to function. The challenge in this project is to have a small transformer, portable but capable of delivery over 10 kV.

TABLE OF CONTENTS

| Contents | <u>page no.</u> |
|--|------------------------|
| Acknowledgement | |
| Abstract | ii |
| Table of Contents | iii |
| | |
| CHAPTER 1 INTRODUCTION | |
| 1.0 Introduction | 1 |
| 1.1 Scope of Project | 4 |
| | |
| CHAPTER 2 CIRCUIT THEORY | |
| 2.0 Introduction | 6 |
| 2.1 Ignitor Circuit Module | 6 |
| 2.2 UJT Relaxation Oscillator | 8 |
| 2.3 Pulse Transformer | 12 |
| 2.4 Laser Head | 12 |
| 2.4.1 Flash Lamp | 13 |
| 2.4.2 Ruby Rod | 15 |

CHAPTER 1

INTRODUCTION

1.0 Introduction

The laser has had a tremendous impact on various fields in science and technology and is a device that seems to have unlimited application. It has practically revolutionised the fields of optical technology and spectroscopy and is now being used in a wide variety of applications in industry such as in medicine, communications, national defence, measurement, and as a precise light source in many scientific investigations. Many types of lasers are commercially available with a large range of output wavelengths and powers [1].

Table 1 : Types of Laser and the Wavelength

| Types of Laser | Wavelength |
|-----------------|------------|
| Argon Laser | 500nm |
| Ruby Laser | 694nm |
| ND-YAG | 1064nm |
| CO ₂ | 10.6um |

Ruby laser is one of solid-state lasers. Ruby belongs to family of gems and is made of Aluminium Oxide (sapphire) containing about 0.05 % Chromium (Cr). The red colour of ruby is caused by the percentage of impurities of chromium atoms that present in the host[2].