

DEVELOPMENT OF SEQUENTIAL CIRCUIT AND  
COUNTER TRAINING SYSTEM

Project report submitted by  
GEORGIADES SAVVAKIS  
in part satisfaction of the award  
in Diploma of Technical Engineer  
in  
Electrical Engineering  
of the  
Higher Technical Institute  
Nicosia Cyprus

June 1990



## ABSTRACT

Title: 'Development of Sequential Circuit And Counter Training System'  
By: Georgiades Savvakis.

The main objectives of the project was the design of a possible layout and prepare the requirements in Circuit design for implementation of Sequential Circuit and counter training System.

The system was designed and constructed having in mind that it is going to be used for experiments of students in the laboratories therefore it should have accessibility and should be easily handled.

Because one of the terms of the project was that maintenance would be easily carried out ribbon cables and there connectors were used. Also most of the wires were labeled.

Testing of the project was carried out progressively i.e. fixing each component (display, Ic's, switches etc) and testing if the expected behaviour was achieved using either the oscilloscope (for the clock cct) and the multimeter (for the power supply, continuity of wires etc).

After testing the project, the experiments which was written for this project were performed in order to check if they work.

Thus all the requirements of the project were achieved and completed.

# CONTENTS

	Page
ACKNOWLEDGEMENTS	I
CONTENTS	II
ABSTRACT	1
INTRODUCTION	2

## CHAPTER 1

1.0 POWER SUPPLY	4
1.1 5V POWER SUPPLY	4
1.2 CIRCUIT DIAGRAM	4
1.3 OPERATION - CALCULATIONS	4
1. PRINTED CIRCUIT BOARD	5
1.5 TESTING POWER SUPPLY	6

## CHAPTER 2

2.0 Square wave generator	8
2.1 Crystal oscillator	8
2.2 Astable multivibrator	9
2.3 Schmitt trigger oscillator	11
2.4 555 Timer	12
2.5 Square wave oscillator used in the experimental logic board	13
2.6 Printed circuit board	16

## CHAPTER 3

3.0 Debounce Switches	17
3.1 Problem appeared with push button switches	17
3.2 How the problem was overcome	18
3.3 Operation of debounce Switch	18
3.4 Printed Circuit Board	19

## CHAPTER 4

4.0 Seven Segment Display Unit	20
4.1 Printed Circuit Board	23

## CHAPTER 5

5.0 Logic Indicators	24
5.1 Printed Circuit Board	26

## CHAPTER 6

6.0 Logic Gates	27
6.1 AND Gate	28
6.2 OR Gate	29
6.3 NOT Gate	30
6.4 NAND Gate	31
6.5 NOR Gate	31
6.6 Exclusive OR Gate	32
6.7 TTL Problem	34
6.8 Printed Circuit Board	35

## CHAPTER 7

7.1 Introduction To Sequential Logic Circuits	36
7.2 JK Flip-Flop	37
7.3 D Flip-Flop	41
7.4 Printed Circuit Board	43

## CHAPTER 8

8.0 74190/74191 Counters	44
8.1 Cascading The 74190 or 74191	45
8.2 74190/74101 As a MOD-N Counter	47
8.3 Printed Circuit Board	49

## CHAPTER 9

9.0 Working With The Training System	50
--------------------------------------	----

### EXPERIMENTS

Experiment no.1 (logic gates)	51
Experiment No.2 (Sequential Logic)	55
Experiment No.3 (Asynchronous Digital Counters)	59
Experiment No.4 (B.C.D Counters)	62
References	64

### APPENDICES