



UNDERGRADUATE COMPUTER ENGINEERING LABORATORY MANUAL (VOL. 3)

MICROPROCESSOR SYSTEM INTERFACING

PROTOTYPING AND PACKAGING

ARTIFICIAL INTELLIGENCE APPLICATIONS



UNIVERSITY OF ILORIN
FACULTY OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF COMPUTER ENGINEERING

ISBN: 978-978-8090-84-2

© January 2018



J.F. Opadiji

*Department of Computer Engineering
University of Ilorin*

A.T. Ajiboye

*Department of Computer Engineering
University of Ilorin*

S.A. Olatunji

*Department of Computer Engineering
University of Ilorin*

S.L. Ayinla

*Department of Computer Engineering
University of Ilorin*

A.R. Ajayi

*Department of Computer Engineering
University of Ilorin*

O.A. Yusuf

*Department of Computer Engineering
University of Ilorin*

H.O. Mahmud

*Department of Computer Engineering
University of Ilorin*

O.F. Adebayo

*Department of Computer Engineering
University of Ilorin*



Foreword

This instruction manual is the third in the series of the undergraduate Computer Engineering laboratory manuals designed to facilitate a practical-oriented approach to learning by students of Computer Engineering in Nigerian universities. In developing this manual, requirements in the Basic Minimum Academic Standard (BMAS) as defined by both the National Universities Commission (NUC) and the Council for the Regulation of Engineering in Nigeria (COREN) for courses to be audited by Computer Engineering undergraduates were considered.

This volume focuses on experiments in **Microprocessor Systems Interfacing, Prototyping and Packaging, and Artificial Intelligence and Applications**. A total of six laboratory sessions are to be performed by students in each of these areas.

At the end of each laboratory session, each student is expected to write a report on the experiments conducted in the workbook provided and submit to laboratory instructors for assessment.

It is our desire that the use of this manual in undergraduate Computer Engineering laboratories will achieve our goal of imparting students with the necessary hands-on experience that will make them productive Computer Engineers in the future.

J.F. Opadiji, Dr.Eng, R.Eng.



TABLE OF CONTENTS

Student Information Page	7
Attendance Page	8
Laboratory Safety Rules and Operating Procedures	10
General Laboratory Safety Information	11
Troubleshooting Hints	13
Guidelines for Laboratory Report Notebook	14
Laboratory Grading Policy	16
UILCPE/MSI 1 – Microcontroller System	17
UILCPE/MSI 2 – Interfacing Seven Segment Display, LCD and Traffic Light with ATMEGA328P	21
UILCPE/MSI 3 – Interfacing Keypad with ATMEGA328P	27
UILCPE/MSI 4 – Using ATMEGA328P for Analog to Digital and Digital to Analog Conversion	29
UILCPE/MSI 5 – Communication between Atmega328p and PC	33
UILCPE/MSI 6 – Interfacing Stepper Motor and Relays with Atmega328p	37
UILCPE/PTP 1 – Soldering Technique	40
UILCPE/PTP 2 – Wire Wrapping Technique	43
UILCPE/PTP 3 – Breadboard and Veroboard	45
UILCPE/PTP 4 – Printed Circuit Board	49
UILCPE/PTP 5 – Radio Frequency (RF) Implementation	51
UILCPE/PTP 6 – Grounding	53
UILCPE/AIA 1 - Developing a Back Propagation Neural Network for Pattern Recognition Systems	55
UILCPE/AIA 2 – Optimizing Constrained and Unconstrained Functions using Genetic Algorithm	59
UILCPE/AIA 3 – Solving a Multiprocessor Scheduling Problem Using Simulated Annealing	64
UILCPE/AIA4 – Predicting Outcomes from Known Input and Response Data using	

Supervised Learning	69
UILCPE/AIA 5 – Building a Self-Organizing Map using Unsupervised Learning	73
UILCPE/AIA 6 – A reinforcement Learning Approach to Solving a Mountain Car Problem	76
APPENDIX 1 – Standard Resistor Colour Code	80