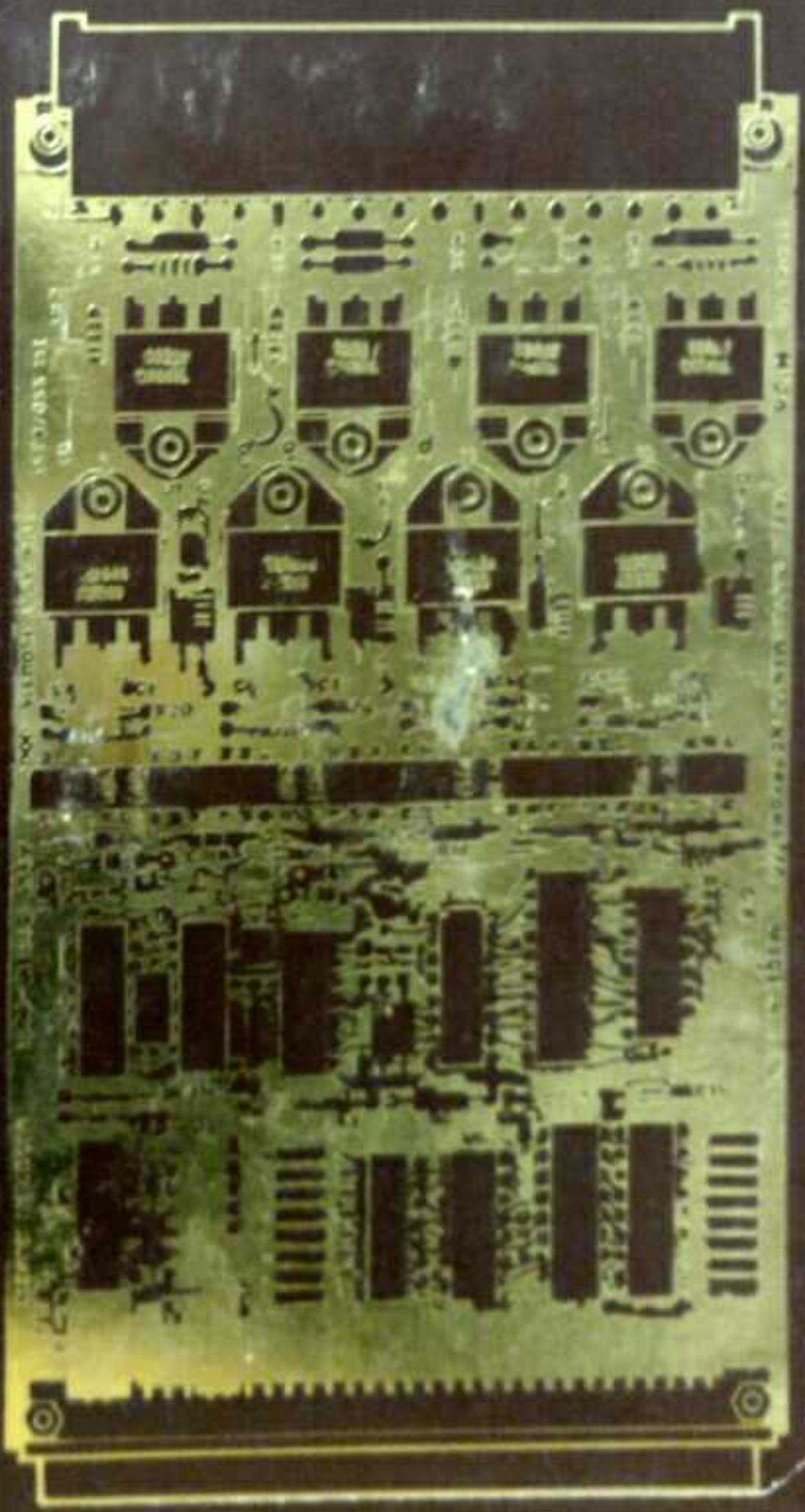
MICROELECTRONIC SYSTEMS

LEVEL II



TECHNICIAN EDUCATION COUNCIL

in association with Hutchinson

33
621-38171
HAL

Microelectronic Systems

Level II

Fred Halsall, MSc, DPhil, CEng, MIEE

Lecturer in Electronics and Computer Science
School of Engineering, University of Sussex

144
SEMINAR LIBRARY
Department of Computer Science
UNIVERSITY OF KARACHI
22.6.94

TECHNICIAN EDUCATION COUNCIL
in association with
HUTCHINSON
London Melbourne Sydney Auckland Johannesburg

Contents

Preface 7
Introduction 9

1 Digital computer principles 11
1.1 Historical development 11
1.2 The stored-program concept 12
1.3 Mode of operation 14
1.4 Digital circuits 15
1.5 The binary system 17
1.6 The computer interface 21
1.7 Basic structure 25
1.8 The fetch–execute cycle 25
Questions 27

2 Microcomputer architecture 28
2.1 Introduction 28
2.2 The memory unit 28
2.3 The microprocessor 33
2.4 The computer bus 35
2.5 The I/O interface unit 37
Questions 39

3 Microprocessor instructions 41
3.1 Introduction 41
3.2 A machine-level instruction 42
3.3 Symbolic notation 43
3.4 Classification of instructions 45
3.5 Instruction addressing modes 47
3.6 Data movement instructions 47
3.7 The Zilog Z80 instruction set 54
3.8 The translation process 55
3.9 Loading and running a programme 56
Questions 59

4 Arithmetic and logic instructions 61
4.1 Introduction 61
4.2 Signed number representation 62
4.3 Arithmetic instructions 63
4.4 The flags register 70

4.5 The carry flag 73
4.6 Binary-coded decimal arithmetic 75
4.7 Logic instructions 80
4.8 Shift instructions 84
4.9 The compare instruction 86
Questions 87

5 Transfer of control instructions 89
5.1 Introduction 89
5.2 The unconditional jump instruction 90
5.3 Conditional jump instructions 93
5.4 Program design 96
5.5 Subroutine implementation 102
Questions 109

6 I/O instructions and associated programming techniques 111
6.1 Introduction 111
6.2 I/O ports 112
6.3 Digital input and output 113
6.4 Some alternative input and display devices 120
6.5 Serial input and output of data 128
6.6 Analogue input and output 136
Questions 139

7 Microcomputer hardware 141
7.1 Introduction 141
7.2 The microprocessor 142
7.3 The microcomputer bus 150
7.4 The memory unit 152
7.5 The I/O interface unit 157
Questions 163

Appendix I: A subset of the Zilog Z80 instruction set 165
Appendix II: ISO/ASCII 7-bit data interchange code 170

Answers to Questions 173

Index 189