

MICROPROCESSOR SYSTEMS

Introduction

The module unit is intended to provide the trainees with theoretical and practical skills for selection, installation and maintenance of microelectronics, micro-computers and micro processor based systems. Trainees undertaking this course will be expected to have covered digital electronics in module 11 of this course.

General Objectives

By the end of the module unit, the trainee should be able to;

- a) Understand the concepts of a microprocessor system.
- b) Program a microprocessor system.
- c) Write and implement micro processor programs.
- d) Diagnose faults in microprocessor systems.

Module Unit Summary and Time Allocation

Microprocessors Systems

Code	Sub Module Unit	Content	Time – Hrs		
			Theory	Practice	Total
30.3.1	Microprocessor Architecture	<ul style="list-style-type: none">• Organization of data registers• Operation of machine cycle	4	-	4
30.3.2	Introduction to Assembly Language programming	<ul style="list-style-type: none">• Machine cycle• Instruction format.• Data transfer instruction programming• Data manipulation• Input/output instructions• Machine control instructions• Transfer of control• Assembler Directives• Addressing Modes• Application programs	6	2	8
30.3.3	Input/output Methods	<ul style="list-style-type: none">• Operation of memory mapped Input/output	4	2	6

		<ul style="list-style-type: none"> • Programmed (memory mapped input/output • Hand shake controlled input/output • Polled input/output 			
30.3.4	Interrupts	<ul style="list-style-type: none"> • Need for interrupts • Operation of the interrupts • Types of interrupts • Application of interrupts 	4	2	6
30.3.5	Direct Memory Access (DMA)	<ul style="list-style-type: none"> • Need for DMA • Operation of DMA • Operation of DMA controller 	6	-	6
30.3.6	Interfacing Devices	<ul style="list-style-type: none"> • Computer internal interface input/output devices • Serial and parallel ports 	8	2	10
30.3.7	Tools in assembly language Programming	<ul style="list-style-type: none"> • Introduction to tools for assembly language programming • Procedure for documentation 	4	2	6
30.3.8	Control structures architecture	<ul style="list-style-type: none"> • Programming control levels • Micro programmed control units 	2	2	4
30.3.9	Microcomputer development	<ul style="list-style-type: none"> • Development aids • Concept, Features and Facilities • Application of development aids in system development 	4	-	4
30.3.10	Microprocessor Applications	<ul style="list-style-type: none"> • Applications 	2	2	4
30.3.11	Microprocessor fault Diagnosis	<ul style="list-style-type: none"> • Types of faults • Fault diagnosis equipment • Fault finding methods 	2	6	8
	TOTAL TIME		46	20	66

30.3.1 MICROPROCESSOR ARCHITECTURE

Theory

30.3.1 T0 *Specific objectives*

By the end of the sub-module unit, the trainee should be able to:

- Describe the organization of data registers
- Explain the operation of machine cycle

Content

30.3.1 TI Description of organization of data registers

- i. Instruction registers
- ii. Programme counter
- iii. Store address register
- iv. General purpose
- v. Accumulator
- vi. Stack pointer
- vii. Arithmetic and logic unit
- viii. Status register

30.3.1 T2 Explanation of operation of machine cycle

30.3.2 INTRODUCTION TO ASSEMBLY LANGUAGE PROGRAMMING

Theory

30.3.2 T0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

- a) Describe a machine cycle
- b) Explain instruction format
- c) Describe data transfer instructions in programming
- d) Describe the instructions in data manipulation group
- e) Describe the input and output instructions
- f) Describe the machine control instructions
- g) Describe transfer of control instructions in programming
- h) Explain the need and use of assembly directives
- i) Explain various addressing modes
- j) Write application programs

30.3.2C Competence

The trainee should have the ability to: write machine code programs for application in microprocessor systems.

Content

30.3.2T1 Machine Cycle

- i. Definition
- ii. Fetch
- iii. Decode
- iv. Execute
- v. Time diagram

30.3.2T2 Instruction format

- i. Label
- ii. Opcode
- iii. Operand
- iv. Comment

30.3.2T3 Data Transfer

30.3.2T4 Data Manipulation

30.3.2T5 Input/output Instructions

30.3.2T6 Machine control Instructions

30.3.2T7 Transfer of instructions

- v. Branch instructions
- vi. Status register/flag register
- vii. Subroutines
- viii. Passing parameter
- ix. Stack operations

30.3.2T8 Assembly directives

- i. Standard
- ii. Macros
- iii. Conditional

30.3.2T9 Addressing modes

- i. Register

- ii. Register indirect
- iii. Immediate
- iv. Absolute
- v. Relative
- vi. Indexed
- vii. Implied
- viii. Direct
- ix. Bit
- x. Implied
- xi. Stack addressing

30.3.2T10 Application programs

Practice

30.3.2P0 Specific Objectives

By the end of the sub-module unit, the trainee should be able to:

- a) Write machine code programs using instruction sets
- b) Hand coding and input machine code programs

Content

30.3.2P1 writing machine code programs

- i. Machine coding
- ii. Inputting a machine code program
- iii. Running the programs

Suggested teaching/learning Activities

- Discussion
- Illustration
- Demonstration
- Note taking
- Practical exercise

Learning Aids/Resources

- Microprocessor training kits
- Assorted microprocessors
- Internet
- Text books

Suggested Evaluation Methods

- Oral tests
- Timed written tests
- Assignments
- Timed practical tests
- Project

30.3.3 INPUT/OUTPUT TECHNIQUE

Theory

30.3.3T0 Specific Objectives

By the end of the sub module unit, the trainee should be able to:

- a) Describe the operation of memory mapped input/output
- b) Describe the operation of programmed input/output
- c) Describe the operation of handshake controlled input/output
- d) Describe the operation of polled input/output

30.3.3C Competence

The trainee should have the ability to perform inputs to a programmable controller

Content

30.3.3T1 Memory mapped input/output

30.3.3T2 Programmed input/output

30.3.3T3 Handshake controlled input/output

30.3.341 Polled input/output

Suggested teaching/Learning Activities

- Discussion
- Illustration
- Demonstration
- Note taking
- Project work
- Visits to industries

Suggested Evaluation Methods

- Oral tests
- Timed written tests
- Assignments

30.3.4 INTERRUPTS

Theory

30.3.4T0 Specific Objectives

By the end of the sub module unit, the trainee should be able to:

- a) Explain the need for interrupt
- b) Describe an interrupt operation
- c) Describe operation of various types
- d) Explain application of interrupts

30.3.4C Competence

The trainee should have the ability to use interrupts

Content

30.3.4T1 Need for interrupt

30.3.4T2 Operation of interrupt

30.3.4T3 Description of the various types of interrupts

- i. Vectored
- ii. Polled
- iii. Hand wired
- iv. Peripheral interrupt controller (PIC)
- v. Masked

30.3.4T4 Applications of interrupts

- i. Single user
- ii. Multi programming
- iii. Polling
- iv. DMA
- v. Job scheduling

Suggested teaching/Learning Activities

- Discussion
- Illustration
- Demonstration

Suggested Evaluation Methods

- Oral tests
- Timed written tests
- Assignments
- Project

30.3.5 DIRECT MEMORY ACCESS

Theory

30.3.5T1 Specific Objectives

By the end of the sub-module unit, the trainee should be able to:

- Explain the need for Direct memory access (DMA)
- Describe the DMA operation
- Describe the operation of DMA controller

Content

30.3.5T1 Explanation of the need of DMA

30.3.5T2 Description of operation of DMA

30.3.5T3 Operation of DMA controller

- Burst mode
- Cycle stealing
- Transparent

30.3.6 INTERFACING DEVICES

Theory

30.3.6T1 Specific Objectives

By the end of the sub-module unit, the trainee should be able to:

- Describe the internal structure of input/output (i/o) computer interfacing devices
- Describe the serial and parallel ports

Content

30.3.6T1 Internal I/O computer interface devices

- i. Operation of typical I/O chip
- ii. Components of I/O chips

30.3.6T2 Serial and parallel ports

- i. Serial controller
- ii. Communication interface devices
 - UART
 - ACIA
 - RS 232/422
 - IEE/488

Suggested teaching/learning Activities

- Discussion
- Illustration
- Visit to industries

Suggested teaching/learning Resources

- Programmable logic controller

Suggested Evaluation Methods

- Oral tests
- Timed written tests
- Assignments
- Timed practical tests

30.3.7 TOOLS IN ASSEMBLY LANGUAGE PROGRAMMING

Theory

30.3.7T0 Specific Objectives

By the end of the sub-module unit, the trainee should be able to:

- a) Describe tools used in assembly language
- b) Explain the procedure of documentation

Content

30.3.7T1 Description of assembly language tools

- i. The editor
- ii. Assembler
- iii. Programmer
- iv. Compiler
- v. Loader etc

30.3.7T2 Explanation of Documentation procedure

- i. Comments
- ii. Printing
- iii. Downloading
- iv. Linking

Suggested teaching/learning Activities

- Discussion
- Illustration
- Visit to industries

Suggested teaching/learning Resources

- Programmable logic controller

Suggested Evaluation Methods

- Oral tests
- Timed written tests
- Assignments
- Timed practical tests

30.3.8 CONTROL STRUCTURES

Theory

30.3.8T0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

- a) Describe the various control levels
- b) Explain micro-programmed controllers

Content

30.3.8T1 Description of control levels

- i. Instruction sequencing
- ii. Instruction interpretation
- iii. Hard wire control
- iv. C.P.U control unit

30.3.8T2 Explanation of Documentation procedure

- i. Micro-programmed control
- ii. Micro-programmed computers
- iii. One-chip computers

30.3.9 MICRO-COMPUTER DEVELOPMENT SYSTEMS

Theory

30.3.9T0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

- a) Explain the various development aids for microcomputers.
- b) Define concepts features and facilities of system development
- c) Apply development aids system developments

Content

30.3.9T1 Explanation of development aids

- i. Hardware
- ii. Micro-processor system
- iii. EPROM programmers
- iv. UV eraser
- v. Software programmes

30.3.9T2 Definition of concepts, feature and facilities

- i. Need
- ii. Types of operating systems
- iii. Functions
- iv. Applications

30.3.9T3 Application of the various system development aids

- Use hardware and software development aids

Suggested teaching/learning Activities

- Discussion
- Illustration
- Visit to industries

Suggested teaching/learning Resources

- Programmable logic controller
- Computers

Suggested Evaluation Methods

- Oral tests
- Timed written tests
- Assignments
- Timed practical tests

30.3.10 MICROPROCESSOR APPLICATIONS

Theory

30.3.10T0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to apply the microprocessor to solve various industrial problems

Content

30.3.10T1 Application of microprocessor in

- i. Traffic lights
- ii. Weighing machines
- iii. Level control
- iv. Timing etc.

30.3.11 MICROPROCESSOR FAULTY DIAGNOSIS

Theory

30.3.11T0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

- a) Identify faults in microprocessor systems
- b) Describe operation of fault finding equipment
- c) Explain methods of fault location in microprocessor systems

30.3.11C Competence

The trainee should have the ability to troubleshoot and repair faults in microprocessor systems.

Content

30.3.11T1 Identification of faults

- a) Timing
- b) Earthing
- c) Noise
- d) Contact bounce
- e) Races
- f) Constructional faults
- g) Wire wrap
- h) Printed grant board (PCB)
- i) Internal and external faults

30.3.11T2 Fault finding equipment

- i. Logic probes
- ii. Current tracer
- iii. Cathode ray oscilloscope
- iv. Logic comparator
- v. Logic pulser
- vi. Logic analyser
- vii. Signature analyser
- viii. Bench mark tests
- ix. Automatic test equipment
- x. ROM test programs
- xi. RAM test programs
- xii. Fault location assignments

30.3.11T3 Fault finding methods

Practice

30.3.11P0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

- a) Identify fault finding equipments using microprocessor systems
- b) Perform fault tracing and repair in microprocessor systems

Content

30.3.11P1 Fault finding equipments

30.3.11P2 Fault tracing and repair

Suggested teaching/learning Activities

- Discussion
- Illustration
- Visit to industries

Suggested teaching/learning Resources

- Programmable logic controller
- Computers
- Microprocessor unit

Suggested Evaluation Methods

- Oral tests
- Timed written tests
- Assignments
- Timed practical tests

