30.3.0 MICROPROCESSOR SYSTEMS

30.3.01 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 II of this course.

30.3.02 General Objectives

At the end of the module unit, the trainee should be able to;
a) Understand the concepts of a microprocessor system.
b) Programme a microprocessor system
c) Write and implement micro processor programs.
d) Diagnose faults in microprocessor systems

30.3.03 Module Unit Summary and Time Allocation

Microprocessors Systems

Code	Sub Module Unit	Content	Time Hrs
30.3.1	Microprocessor Architecture	• Organization of data registers • Operation of machine cycle	4
30.3.2	Introduction to Assembly Language Programming	• 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	8
30.3.3	Input/output Methods	• Operation of memory mapped input/output • Programmed (memory Mapped) input/output • Hand shake controlled input/output • Polled input/output	6
30.3.4	Interrupts	• Need for interrupt • Operation of the interrupts	6

		• Types of interrupts • Applications of interrupts	
30.3.5	Direct Memory Access	• Need for DMA • Operation of DMA • Operation of DMA controller	6
30.3.6	Interfacing Devices	• Computer Internal interface input/output devices • Serial and parallel ports	8
30.3.7	Tools in assembly language programming	• Introduction to tools for assembly language programming • Procedure for documentation	4
30.3.8	Control Structures architecture	• Programming control Levels • Micro programmed control units	4
30.3.9	Micro-computer Development	• Development aids • Concepts, Features and Facilities • Application of development aids in system development	4
30.3.10	Microprocessor Applications	• Applications of microprocessors	4
30.3.11	Microprocessor fault diagnosis	• Types of faults • Fault diagnosis equipment • Fault finding methods	8
Total Time			66

30.3.1 MICROPROCESSOR ARCHITECTURE

Theory

30.3.1T0 *Specific Objectives*
By the end of the sub - module unit, the trainee should be able to:
a) describe the organization of data registers
b) explain the operation of machine cycle

Content
30.3.1T1 Description of organization of data registers
i) Instruction register
ii) Programme counter
iii) Store address register
iv) General purpose
v) Accumulator
vi) Stack pointer
vii) Arithmetic and logic unit
viii) Status register
30.3.1T2 Explanation of operation of machine cycle

30.3.2 INTRODUCTION TO ASSEMBLY LANGUAGE PROGRAMMING

Theory

30.3.2T0 *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

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) Parameter passing
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

30.3.2C **Competence**
The trainee should have the ability to: write machine code programs for application in microprocessor systems

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

Content
30.3.3T1 Memory mapped input/output
30.3.3T2 Programmed input/output
30.3.3T3 Handshake controlled input/output
30.3.3T4 Polled input/output

30.3.3C   Competence
The trainee should have the ability to: perform inputs to a programmable controller

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

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

30.3.4C   Competence
The trainee should have the ability to use interrupts

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:
a) explain the need for Direct Memory Access (DMA)
b) describe the DMA operation
c) 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
   i) Burst Mode
   ii) Cycle Stealing
   iii) 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:
a) describe the internal structure of input /output (I/O) computer interfacing devices
b) 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
   - Visits 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 programming
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
- Visits 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 Micro – programmed Controller
i)   Micro-programmed control

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 in system developments

Content

30.3.9T1   Explanation of development aids
i)   Hardware
ii)   Micro-processor system
iii) EPROM programmes
iv)   UV eraser
v)   Software programmes

30.3.9T2   Definition of Concept, 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

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Suggested teaching/Learning Activities
- Discussion
- Illustration
- Visits 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 APLICATIONS

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 the microprocessor in
i) Traffic lights
ii) Weighing machines
iii) Level control
iv) Timing etc.

30.3.10 MICROPROCESSOR FAULTY DIAGNOSIS

Theory

30.3.10T0 *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

Content
30.3.10T1 Identification of Faults
i) Timing
ii) Earthing
iii) Noise
iv) Contact bounce
v) Races
vi) Constructional Faults
vii) Wire wrap
viii) Printed grant board (PCB)
ix) Internal & external faults

30.3.10T2 Fault Finding Equipment
i) Logic probes
ii) Current tracer
iii) Cathode ray oscilloscope (CRO)
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

30.3.10T3   Fault Finding methods

Practice

30.3.10P0   *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
30.3.10P1   Fault finding equipments
30.3.10P2   Fault tracing and repair

30.3.10C   Competence
The trainee should have the ability to: trouble shoot and repair faults in microprocessor systems

Suggested teaching/Learning Activities
- Discussion
- Illustration
- Visits to industries

Suggested teaching/Learning Resources
- Programmable Logic controller
- Computers
- Microprocessor unit

Suggested Evaluation Methods
- Oral tests

- Timed written tests
- Assignments
- Timed practical tests