MGM's
Jawaharlal Nehru Engineering College

Electrical Engineering Department

Laboratory Manual

Microprocessor and Microcontroller

For

Third Year (EEP) Students

Manual made by

Prof. J.R.Rana

EE Department

FOREWORD

It is my great pleasure to present this laboratory manual for third year **ELECTRICAL ELECTRONIC & POWER** engineering students for the subject of Microcontroller Applications. Keeping in view the vast coverage required for visualization of concepts of 8085 and 8051 with simple language.

As a student, many of you may be wondering with some of the questions in your mind regarding the subject and exactly what has been tried is to answer through this manual.

Faculty members are also advised that covering these aspects in initial stage itself, will greatly relive them in future as much of the load will be taken care by the enthusiasm energies of the students once they are conceptually clear.

Dr.H.H.Shinde

Principal

LABORATORY MANUAL CONTENTS

This manual is intended for the third year students of **ELECTRICAL ELECTRONIC & POWER** engineering branch in the subject of Microcontroller Applications. This manual typically contains practical/Lab Sessions related to Microprocessor 8085 and Microcontroller 8051 covering various aspects related to the subject to enhance understanding.

Although, as per the syllabus, only descriptive treatment is prescribed, we have made the efforts to cover various aspects of microcontroller subject covering types of different aspects of 8051 Microcontroller Applications to make it meaningful, elaborative understandable concepts and conceptual visualization.

Students are advised to thoroughly go through this manual rather than only topics mentioned in the syllabus as practical aspects are the key to understanding and conceptual visualization of theoretical aspects covered in the books.

Good Luck for your Enjoyable Laboratory Sessions

Prof. J.R.Rana

MAHATMA GANDHI MISSION`S

JAWAHARLALNEHRUENGINEERINGCOLLEGE

AURANGABAD.

Department of Electrical Engineering

Vision of JNEC

To create self-reliant, continuous learner and competent technocrats imbued with human values.

Mission of JNEC

1. Imparting quality technical education to the students through participative teaching –learning process.
2. Developing competence amongst the students through academic learning and practical experimentation.
3. Inculcating social mindset and human values amongst the students.

Department of Electrical Engineering

VISION:

- To Develop competent Electrical Engineers with human values.

MISSION:

- To Provide Quality Technical Education To The Students Through Effective Teaching-learning Process.
- To Develop Student's Competency Through Academic Learning, Practicals And Skill Development Programs.
- To Encourage Students For Social Activities & Develop Professional Attitude Along With Ethical Values.

Programme Educational Objectives (Peos)

- To equip the engineers of tomorrow to cope up with the fast paced field of Electrical Engineering.
- To update the students with the latest cutting edge technologies by organizing talks, seminars and workshops.
- To reinforce the importance of team work in students by undertaking minor and major projects.
- To inculcate an attitude of commitment to quality among students.

PRACTICAL ASSESSMENT FOR MICROCONTROLLER APPLICATIONS WILL BE AS FOLLOWS.

Term Work Marks	Regular Practical Attendance	Regular Practical Performance	Practical Submission	Assignment Submission	Theory Attendance	Teachers Evaluation
50	15	10	5	5	10	5

Rubric for Performance submission

CR1: Punctuality in reporting

CR2: Doing work independently

CR3: Completing assigned practical with understanding

Rubric for Practical submission

CR1: Complete write-up of experiment

CR2:Neat and tidy work

CR3:Timely submission

Assessment of Practical's will be as followed

A grade : All CR fulfilled

B grade: Any 2 CR fulfilled

C grade : Otherwise

- Grades : Marks
- Grade A : 3
- Grade B : 2
- Grade C : 1
- **Example :** For 8 practical's a B.E student has got **five** A grades and **three** B grades in **Practical performance** criteria (06 marks)

  Marks = (5 * 3 + 3 * 2)/(3 * 8) * 6 =5.25= **05 Marks**

Theory Attendance Marks

No of absentee	Marks to be allotted out of 25	Marks to be allotted out of 50
00	07	15
01	06	13
02	05	11
03	04	09
04 and more	03	07

Practical attendance Marks

% of Theory Attendance	Theory Attendance Marks(Out Of 10)
>=90%	10
85-89%	9
80-84%	8
75-79%	7
70-74%	6
69% and less	5

SUBJECT INDEX

I .DO's and DON"T's in Laboratory:

- Do not handle any kit before reading the instructions/Instruction manuals.
- Use correct power supply with the proper kit.
- Do not forcefully place connectors to avoid the damage.
- Strictly observe the instructions given by the teacher/Lab Instructor.

Instruction for Laboratory Teachers:

- Lab work completed during prior session, should be corrected during the next lab session.
- Students should be guided and helped whenever they face difficulties.
- The promptness of submission should be encouraged by way of marking and evaluation patterns that will benefit the sincere students.

II. Lab Exercises: Part A

[Purpose of these exercises is to introduce the students to concepts of digital electronics used in microcontroller programming followed by introduction to the simulator.

Exercises 1: Use of Digital Electronics in programming of 8051 Microcontroller.

THEORY:

A. Revision of concept of Register (8 bit) , Memory devices, Counter, Timer.

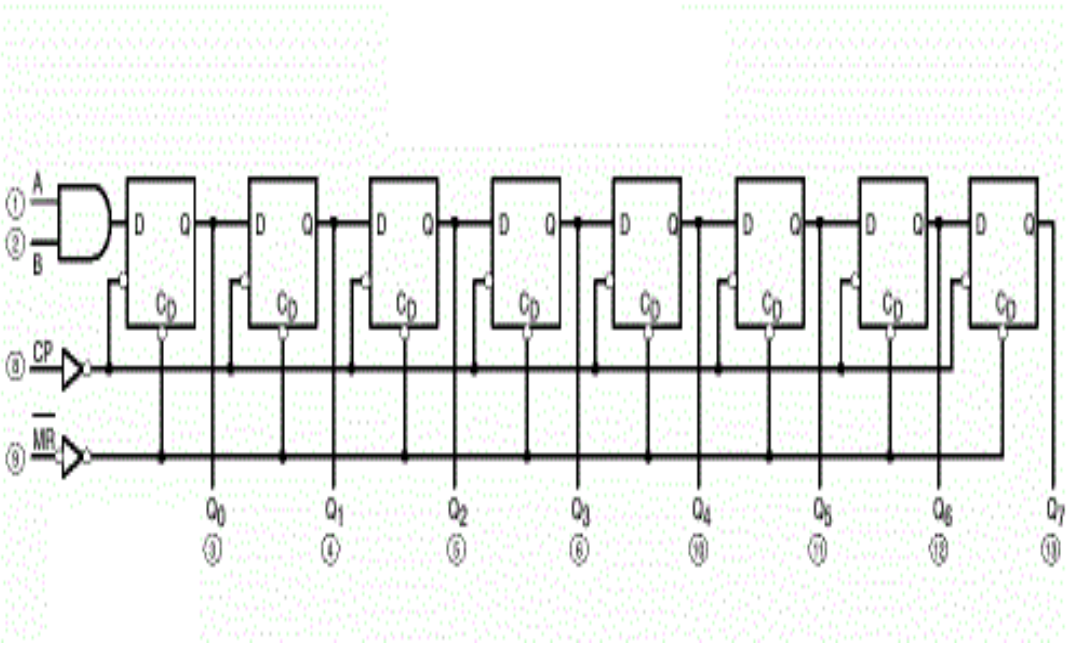
B. Revision of Data processing techniques.

Details:

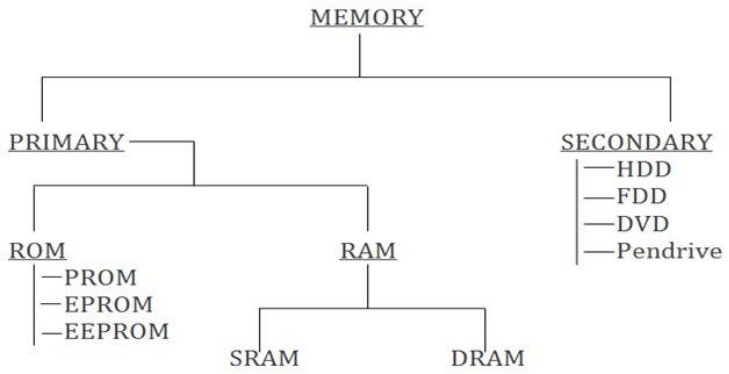
1. Definition of Flip-flops
2. Applications of flip-flop.
3. Types of Register.
4. Types of Memory Devices.
5. Use of counter and Timer.

6. Data transfer techniques.

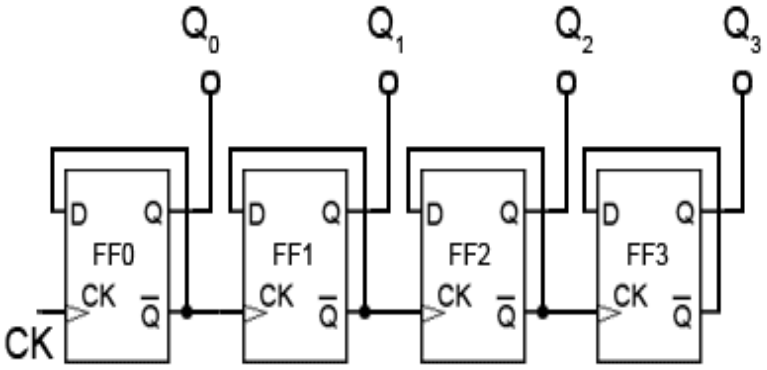
1. Register:



2. Memory Devices:



3. Counter/Timer:



Data processing techniques details:

1. Synchronous Data and Asynchronous data

2. FIFO, LILO, FILO, LIFO.

3. Serial Data communication and Parallel Data Communication.

Conclusion:

An introduction to the flip flop and its applications as well as data processing techniques from digital electronics is necessary to understand the working of microcontroller.

II. Lab Exercises: Part A

Exercise No.2: Introduction to 8085 microprocessor and 8051 Microcontroller.

Get introduced with Microcontroller kit and MCU8051 simulator.

II. Lab Exercises: Part B

Exercise No.1: Assembly Language programs Addition and Substraction.

Aim : To Execute assembly language program for addition and substracction of two 8 bit numbers.

Algorithm:

- Load register A with given value.
- Load any register with given value.
- Add/Substract contents of register & register A.
- Store result.

Program : 8 Bit

```
MOV A, #24
MOV R0, # 23
ADD A, R0
RET
```

Program : 8 Bit

```
MOV A, #24
MOV R0, # 23
SUB A, R0
RET
```

Assignment: Perform Addition and Subtraction of two 8/16 bit number on 8085 kit.

Conclusion: Thus, the program for addition and substraction of two 8/16 bit numbers is successfully executed. The result of arithmetic operation can be stored in internal as well as external memory location.

Exercise No.2: Assembly Language programs Multiplication and division of 8 bit numbers.

Aim: To Execute assembly language program for multiplication/division of two 8 bit numbers.

Algorithm:

a. Load register A with given value.

b. Load any other register with given value.

c. Multiply/Divide contents of register & Accumulator.

d. Store result.

Program : Multiplication.

```
MOV A, #51
MOV B, #05
MUL AB
MOV R0,A
END
```

Program : Division.

```
MOV A, #51
MOV B, #05
DIV AB
MOV R0,A
END
```

Assignment: Perform Multiplication and Division of two 8 bit number on 8085 kit.

Conclusion: Thus, the program executed for Multiplication and Division of two 8 bit numbers is successfully executed. The separate instruction of multiplication and division is available for 8051 microcontroller which is not available for 8085 microprocessor.

Exercise No.3: Assembly language program of finding the average of five numbers.

Aim: To Execute assembly language program for the average of five numbers**.**

Algorithm:

1. Load registers five numbers with given value.
2. Perform addition of these five numbers.
3. Divide contents with 5 and obtain average.
4. Store result.

Program:

```
MOV 60H,#06
MOV 61H, #35
MOV 62H, #15
MOV 63H, #55
MOV 64H, #05
MOV R0, #60H
MOV R1, #05
MOV A, @R0
  DEC R1
  UP:INC R0
  ADD A,@R0
  DJNZ R1,UP
  MOV B, #05
  DIV AB
MOV 50H, A
END
```

Assignment: Obtain percentage of marks obtained for student in 6 subject.

Conclusion: Thus, the program executed for finding the average of five numbers. This program demonstrates that multiple arithmetic operations can be executed in a single program to perform complex arithmetic operation.

Exercise No.4: Assembly language program of finding the Largest/Smallest number.

Aim: To Execute assembly language program for the finding the Largest/Smallest number.

Algorithm:

1. Load two numbers with given value.
2. Perform comparison of these numbers.
3. Obtain largest/smallest number.
4. Store result.

Program:

```
MOV 51H,#03
MOV 52H,#05
MOV R0, #51H
MOV A, @R0
INC R0
CLR C
SUBB A, @R0
JNC NEXT
SJMP LARGE
NEXT: DEC R0
LARGE: MOV 53H,@R0
END
```

Program:

```
MOV 51H,#03
MOV 52H,#05
MOV R0, #51H
MOV A, @R0
INC R0
CLR C
SUBB A, @R0
JC NEXT
SJMP SMALL
NEXT: DEC R0
LARGE: MOV 53H,@R0
END
```

Assignment: Find largest/smallest number from an array.

Conclusion: Thus, the program executed for finding the largest/smallest number. This program demonstrates that specific data parameter can be obtained by using conditional instructions.

Exercise No.5: Generation of time delay.

Aim: To Execute program for generation of time delay.

Algorithm:

1. Load hex code of constant.
2. Store hex code in a register and decrement it.
3. Repeat the loop.
4. Return to main program.

Program:

```
DELAY:
MOV R2,#25
UP:DEC R2
DJNZ R2,UP
RET
```

Assignment: Generate a delay of 50microseconds, 5miliseconds.

Conclusion: Thus, the program executed for delay subroutine. This program demonstrates that by using register in combination large amount of time delay can be generated for interfacing operation.

Exercise No.6: LED Interfacing.

Aim: To Execute program for generating pattern using LED interfacing.

Algorithm:

1. Load two numbers with given value.
2. Provide output to the LED.
3. Obtain blinking pattern.
4. Conclude program.

Program:

```
REP:
MOV A, #00
MOV P0, A
CALL SUB
MOV A, #255
MOV P0, A
CALL SUB
SJMP REP
SUB:
MOV R2, #02
UP: DEC R2
DJNZ R2, UP
RET
```

Assignment: Develop a table for different blinking pattern for LED's.

Conclusion: Thus, the program executed for LED blinking. This program demonstrates that by using numeric values and interfacing of LED different patterns of lighting can be generated.

Exercise No7: Seven Segment Display Interfacing.

Aim: To Execute program for representing number 0 to 9 on seven segment display.

Algorithm:

1. Load hex code of decimal number 0 to 9.
2. Provide hex code to display unit and provide delay.
3. Obtain numbers on display.
4. Conclude program.

Program:

```
REP:
MOV A,#255
MOV P0,A
CALL SUB
MOV A,#2
MOV P0,A
CALL SUB
MOV A,#00
MOV P0,A
CALL SUB
MOV A,#72
MOV P0,A
CALL SUB
MOV A,#8
MOV P0,A
CALL SUB
SJMP REP
SUB:
MOV R2,#2
UP:DEC R2
DJNZ R2,UP
RET
```

Data: Select number 0 and 9 and obtain its hex code.

Assignment: Write a table for display A to F on seven segment display.

Conclusion: Thus, the program executed for seven segment interfacing. This program demonstrates that by using numeric values and its hex code alphanumeric data can be generated on seven segment display.

Exercise No.8: Stepper motor control using microcontroller.

Aim: To Execute program for controlling the operation of stepper motor.

Algorithm:

1. Load hex code of constant.
2. Store hex code in a register and provide it to port .
3. Call delay change hex code and repeat.
4. Obtain stepper motor rotation.

Program:

```
UP:MOV A,#255
MOV P0,A
CALL SUB
RRC
JMP UP:
SUB:
MOV R2,#25
UP:DEC R2
DJNZ R2,UP
RET
```

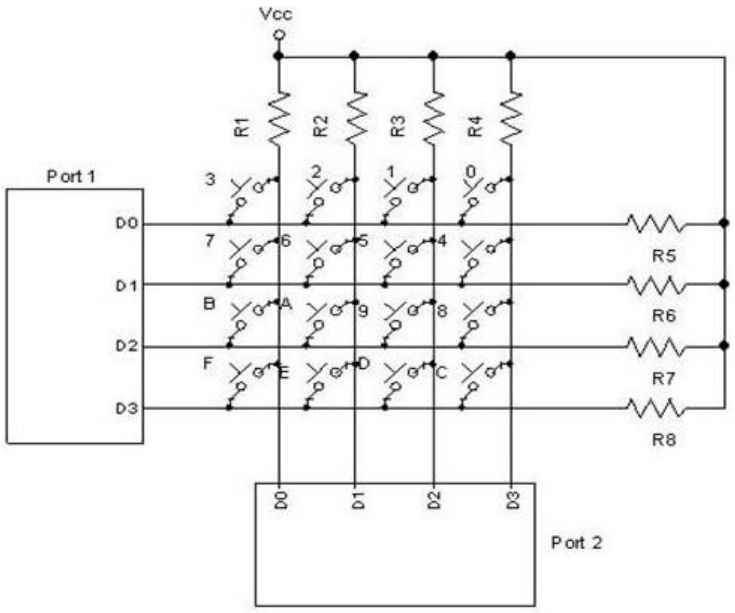
Assignment: Write a table for clock wise and anticlockwise rotation.

Conclusion: Thus, the program executed for stepper motor operation control. This program demonstrates that by using microcontroller interfacing rotation, speed as well as normal operation of stepper motor can be executed. Same is applicable to DC motor interfacing.

Exercise No.9: Keyboard Interfacing.

Aim: To study program for keyboard interfacing with microcontroller.

Circuit Arrangement:



Assignment: Develope Algorithm and Program for keyboard interfacing.

Conclusion: Thus, the program executed for keyboard interfacing.

II. Lab Exercises: Part C

Exercise: Miniproject on Application of Microcontroller.

Aim: To build a simulation/Hardware based small project on application of Microcontroller.

Statement: Project Topic:

1. Object Counter.
2. LED Lighting.
3. Temperature sensor based Fan regulator.
4. Luminance sensing based light control using Microcontroller.
5. Water tank cutoff and buzzer.
6. Display message on LCD display device.
7. Simple Automation of electronics equipment.

Procedure:

1. Form a group of five students within batch.
2. Select a project out of above topics.
3. Purchase component/Simulate and execute programming.
4. Obtain output.

Conclusion:

3. Quiz on the subject:

Quiz should be conducted on tips in the laboratory, recent trends and subject knowledge of the subject. The quiz questions should be formulated such that questions are normally are from the scope outside of the books. However twisted questions and self formulated questions by the faculty can be asked but correctness of it is necessarily to be thoroughly checked before the conduction of the quiz.

Sample Questions:

- Define Microprocessor and Microcontroller.
- Define stack, stack pointer.
- Define Memory.
- What is RAM? Is RAM a volatile memory?
- What is ROM? Is ROM used to store the binary codes for the instructions or lookup table? Why?
- What is the function of 'Timing and control unit' in Microcontroller?
- Which are the different types of buses used in Microcontroller?
- Explain fetching, decoding and execution operations of Microcontroller..
- Explain the difference between PROM, EPROM AND EEPROM.
- Explain Different Blocks Of Microcontroller and Microprocessor.
- How many data lines, address lines are present in 8085/8051.
- How many address lines are required to access 2MB of memory?
- List the internal registers in 8085/8051.Describe the primary function of each register.
- Give the clock frequency of 8085/8051
- Give the format of Flag Register in 8085/8051.Explain each flag.
- What is the use of ALE signal?
- What is the use of 'clock out' and 'reset out' signals of 8085/ 8051?
- Describe function of following pins in 8051:
    - READY (2) ALE (3) IO/M' (4) HOLD (5) RESET
- List the instructions related to DMA operation in 8051.
- List out different control signals used by 8051.
- On power on reset, what is the content of PC ?
- List the instructions related to serial operation in 8051.
- List the different addressing modes of 8051.
- Explain following instructions:
    - PUSH 2)POP 3)CALL 4)RET
- Explain 8255.

1. Conduction of Viva-Voce Examinations:

Teacher should conduct oral exams of the students with full preparation. Normally, the objective questions with guess should be avoided. To make it meaningful, the questions should be such that depth of the students in the subject is tested. Oral examinations are to be conducted in cordial environment amongst the teachers taking the examination. Teachers taking such examinations should not have ill thoughts about each other and courtesies should be offered to each other. Difference of opinion, if any, should be critically suppressed in front of the students.

1. Evaluation and marking system:

Basic honesty in the evaluation and marking system is absolutely essential and in the process impartial nature of the evaluator is required in the examination. It is a wrong approach to award the students by way of easy marking to get cheap popularity among the students, which they do not deserve. It is a primary responsibility of the teacher to see that right students who are really putting up lot of hard work with right kind of intelligence are correctly awarded.

The marking patterns should be justifiable to the students without any ambiguity and teacher should see that students are faced with just circumstances.