QMP 7.1 D/F

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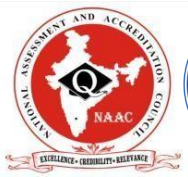

Department of Electronics & Communication Engineering

MICROCONTROLLERS LABORATORY

BECL456A

B.E – IV Semester

Lab Manual 2024-25

Name : _____

USN : _____

Batch :_____Section : _____

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Department of Electronics & Communication Engineering

MICROCONTROLLERS LABORATORY

BECL456A

CIT GUBBI ECE DEPT

Prepared by:
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Assistant Professor

Reviewed by:
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Assistant professor

Approved by:
Dr.Thejaswini R
Professor & Head,Dept. of ECE

INSTITUTE VISION

To create centres of excellence in education and to serve the society by enhancing the quality of life through value based professional leadership.

INSTITUTE MISSION

- To provide high quality technical and professionally relevant education in a diverse learning environment.
- To provide the values that prepare students to lead their lives with personal integrity, professional ethics and civic responsibility in a global society.
- To prepare the next generation of skilled professionals to successfully compete in the diverse global market.
- To promote a campus environment that welcomes and honors women and men of all races, creeds and cultures, values and intellectual curiosity, pursuit of knowledge and academic integrity and freedom.
- To offer a wide variety of off-campus education and training programmes to individuals and groups.
- To stimulate collaborative efforts with industry, universities, government and professional societies.
- To facilitate public understanding of technical issues and achieve excellence in the operations of the institute.

QUALITY POLICY

Our organization delights customers (students, parents and society) by providing value added quality education to meet the national and international requirements. We also provide necessary steps to train the students for placement and continue to improve our methods of education to the students through effective quality management system, quality policy and quality objectives.

Vision

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

To create globally competent Electronics and Communication Engineering

Mission

professionals with ethical and moral values for the betterment of the society

- To nurture the technical/professional/engineering and entrepreneurial skills for overall self and societal upliftment through co-curricular and extra-curricular events.
- To orient the Faculty, Students and Community towards the higher education, research and development activities.
- To create the Centres of Excellence in the field of electronics and communication in collaboration with industries/Universities by training the faculty through latest technologies.
- To impart quality technical education in the field of electronics and communication engineering to meet over the current/future global industry requirements.

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Karnataka

Program Educational Objectives (PEO's)

After four Years of Graduation, our graduates are able to:

- Provide technical solutions to real world problems in the areas of electronics and communication by developing suitable systems.
- Pursue engineering career in Industry and/or pursue higher education and research.
- Acquire and follow best professional and ethical practices in Industry and Society.
- Communicate effectively and have the ability to work in team and to lead the team.

Program Specific Outcomes (PSO's)

At the time of graduation, our graduates are able to:

PSO1: Specify, design, build and test analog and digital systems for signal processing including multimedia applications, using suitable components or Simulation tools.

PSO2: Understand and architect wired and wireless analog and digital Communication systems as per specifications and determine their performance.

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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

SYLLABUS

B.E: Electronics & Communication Engineering / B.E: Electronics & Telecommunication Engineering
NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2021 – 22)
SEMESTER – IV

Embedded C Basics LABORATORY

Laboratory Code	**BECL456A**	**CIE Marks**	**50**
Number of Lecture Hours/Week	0:0:2:0	**SEE Marks**	**50**
RBT Level	**L2, L3**	**Exam Hours**	**03**
CREDITS – 01			

Laboratory Experiments

Sl.No	Experiments
	Execute the following experiments by using Keil Microvision Simulator (any 8051 Microcontroller can be chosen as the target) and Hardware Interfacing Programs using 8051 Trainer Kit.
	Assembly Language Programming
1	Write an ALP to move a block of n bytes of data from source (20h) to destination (40h) using Internal-RAM.
2	Write an ALP to move a block of n bytes of data from source (2000h) to destination (2050h) using External RAM.
3	Write an ALP To exchange the source block starting with address 20h, (Internal RAM) containing N (05) bytes of data with destination block starting with address 40h (Internal RAM).
4	Write an ALP to exchange the source block starting with address 10h (Internal memory), containing n (06) bytes of data with destination block starting at location 00h (External memory).
5	Write an ALP to add the byte in the RAM at 34h and 35h, store the result in the register R5 (LSB) and R6 (MSB), using Indirect Addressing Mode.
6	Write an ALP to subtract the bytes in Internal RAM 34h &35h store the result in register R5 (LSB) & R6 (MSB).
7	Write an ALP to multiply two 8-bit numbers stored at 30h and 31h and store16- bit result in 32h and 33h of Internal RAM.
8	Write an ALP to perform division operation on 8-bit number by 8-bit number.
9	Write an ALP to separate positive and negative in a given array.
10	Write an ALP to separate even or odd elements in a given array.
11	Write an ALP to arrange the numbers in Ascending & Descending order.
12	Write an ALP to find Largest & Smallest number from a given array starting from 20h & store it in Internal Memory location 40h.
13	Write an ALP for Decimal UP-Counter.
14	Write an ALP for Decimal DOWN-Counter.
15	Write an ALP for Hexadecimal UP-Counter.

16	Write an ALP for Hexadecimal DOWN-Counter.
C Programming	
17	Write an 8051 C program to find the sum of first 10 Integer Numbers.
18	Write an 8051 C program to find Factorial of a given number.
19	Write an 8051 C program to find the Square of a number (1 to 10) using Look-Up Table.
20	Write an 8051 C program to count the number of Ones and Zeros in two consecutive memory locations.
Hardware Interfacing Programs	
21	Write an 8051 C Program to rotate stepper motor in Clock & Anti-Clockwise direction.
22	Write an 8051 C program to Generate Sine & Square waveforms using DAC interface.

Conduct of Practical Examination:

- All laboratory experiments are to be included for practical examination.
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
- Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

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Department of Electronics and Communication Engineering

Embedded C LABORATORY: Course Objectives and Outcomes

COURSE OBJECTIVES :

The main objectives of this lab are,

- Understand the basic programming of Microcontrollers.
- Developthe8051 Microcontroller-basedprogramsforvariousapplicationsusing Assembly Language & C Programming.
- Program8051Microcontrollertocontrolanexternalhardwareusingsuitable I/Oports.

COURSE OUTCOMES :

After completing this course the student could be able to:

1. Write a Assembly Language/C programs in 8051 for solving simple problems that manipulate input data using different instructions.
2. Write C programs in 8051 for solving simple problems that manipulate input data using different instructions of 8051 C.
3. Develop testing and experimental procedures on 8051 Microcontroller, analyze their operation under different cases.
4. Develop programs for 8051 Microcontroller to implement real world problems.
5. Develop microcontroller applications using external hardware inter

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Department of Electronics and Communication Engineering

'Instructions to the Candidates'

- Student should come with thorough preparation for the experiment to be conducted.
- Student should take prior permission from the concerned faculty before availing the leave.
- Student should come with proper dress code and to be present on time in the laboratory.
- Student will not be permitted to attend the laboratory unless they bring the practical record fully completed in all respects pertaining to the experiment conducted in the previous class.

- Student will not be permitted to attend the laboratory unless they bring the observation book fully completed in all respects pertaining to the experiment to be conducted in present class.
- Experiment should be started conducting only after the staff-in-charge has checked the circuit diagram.
- All the calculations should be made in the observation book. Specimen calculations for one set of readings have to be shown in the practical record.
- Wherever graphs to be drawn, A-4 size graphs only should be used and the same should be firmly attached in the practical record.
- Practical record and observation book should be neatly maintained.
- Student should obtain the signature of the staff-in-charge in the observation book after completing each experiment.
- Theory related to each experiment should be written in the practical record before procedure in your own words with appropriate references.

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Sl. No	Name of the Experiment	Date			Manual Marks (Max . 20)	Record Marks (Max. 10)	Signature (Student)	Signature (Faculty)
		Conduction	Repetition	Submission of Record				
1	Write an ALP to move a block of n bytes of data from source (20h) to destination (40h) using Internal-RAM.							
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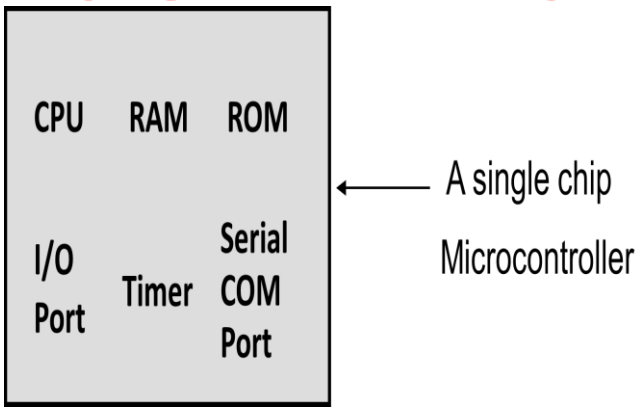
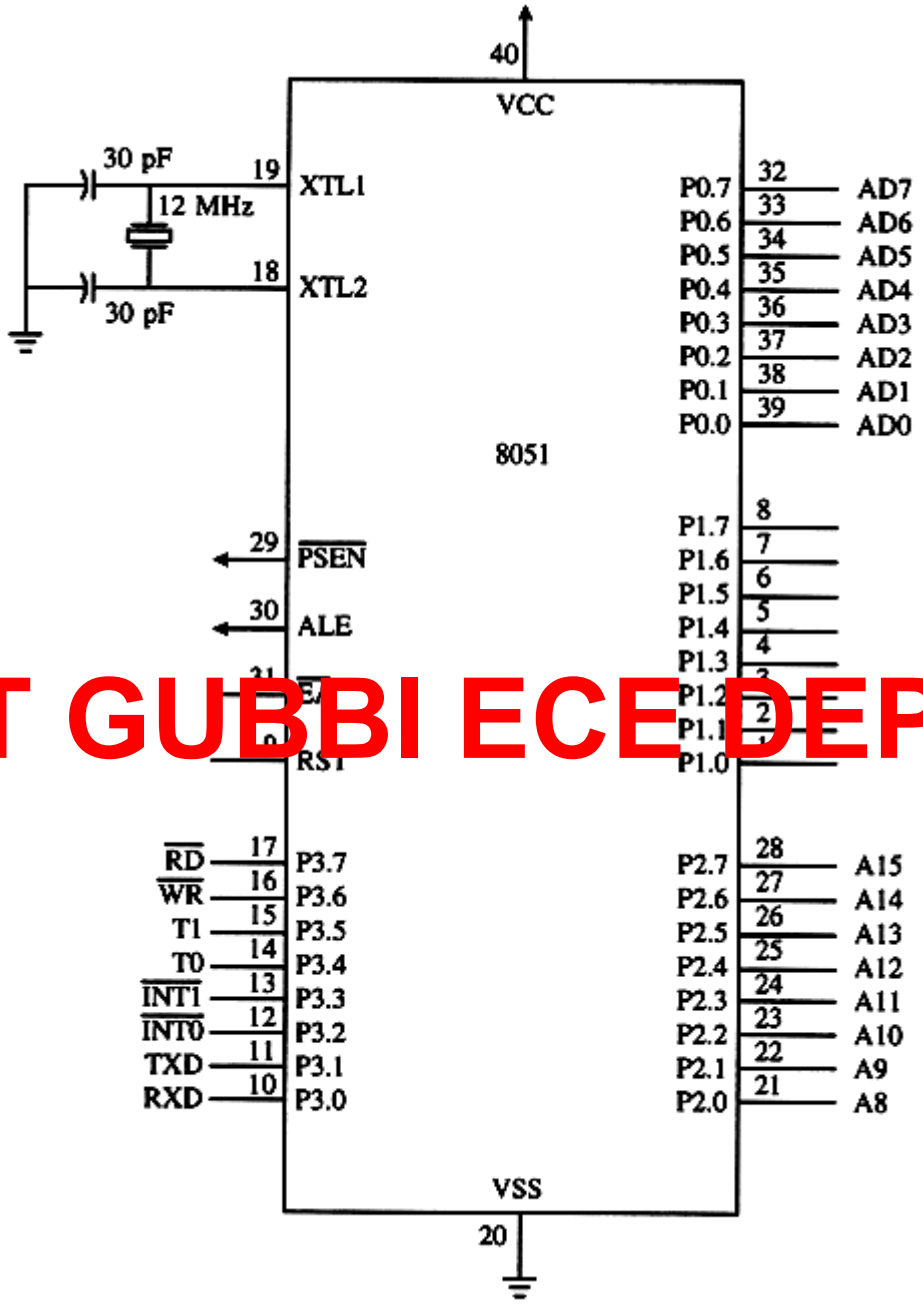
22	Write an 8051 C program to Generate Sine & Square waveforms using DAC interface.							
Average								

8051 Basic Component

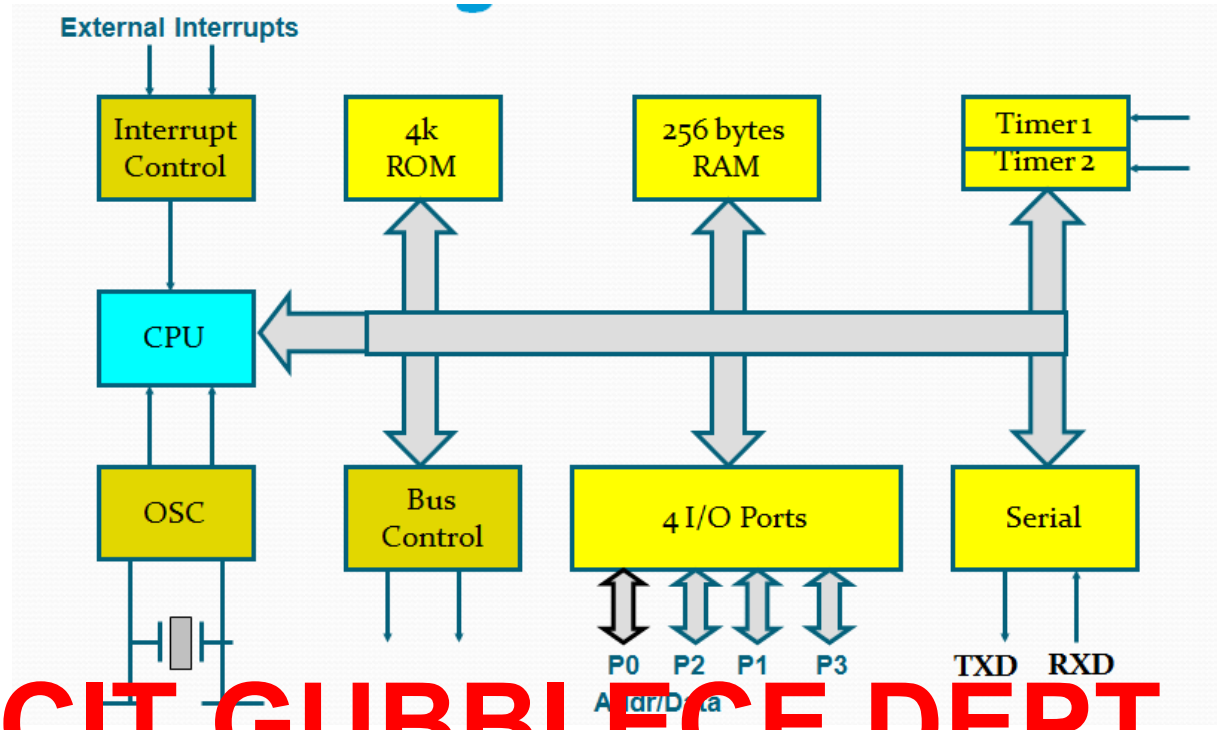
- 4K bytes internal ROM
- 256 bytes internal RAM
- Four 8-bit I/O ports (P0 - P3).
- Two 16-bit timers/counters
- One serial interface

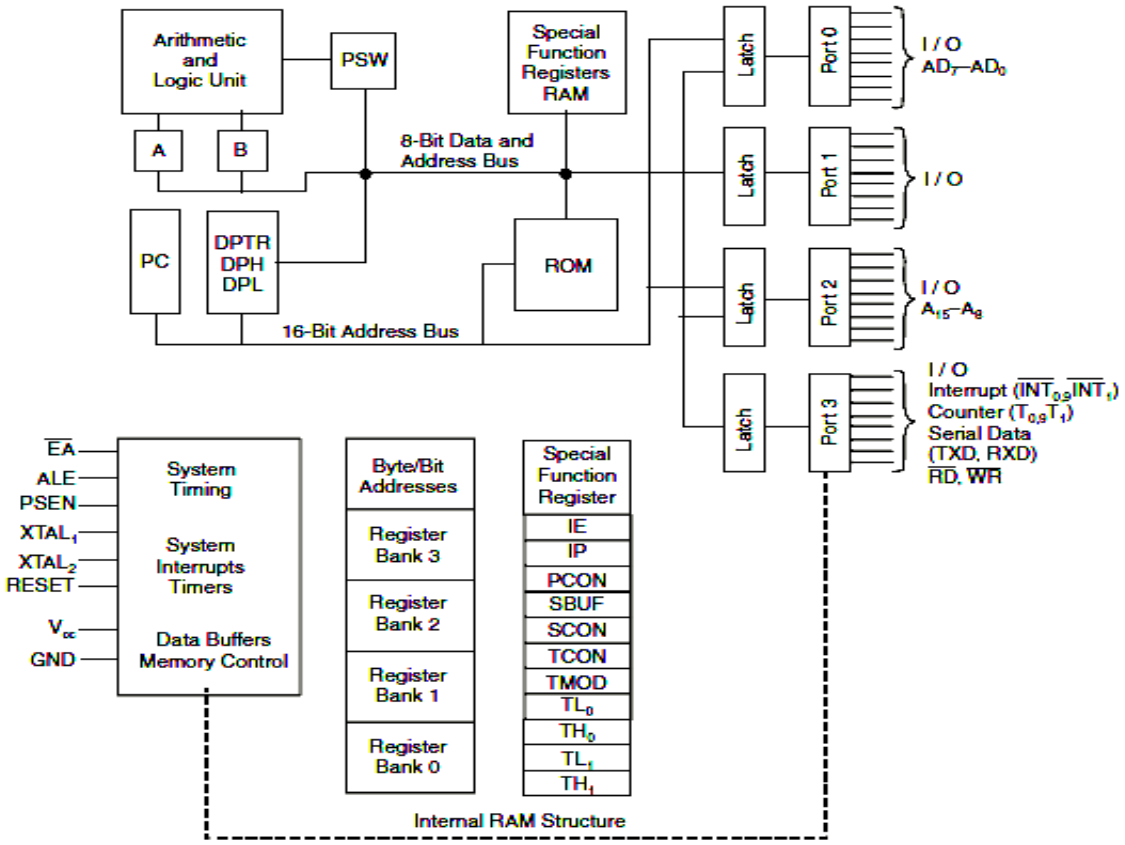


8051 Schematic Pin out



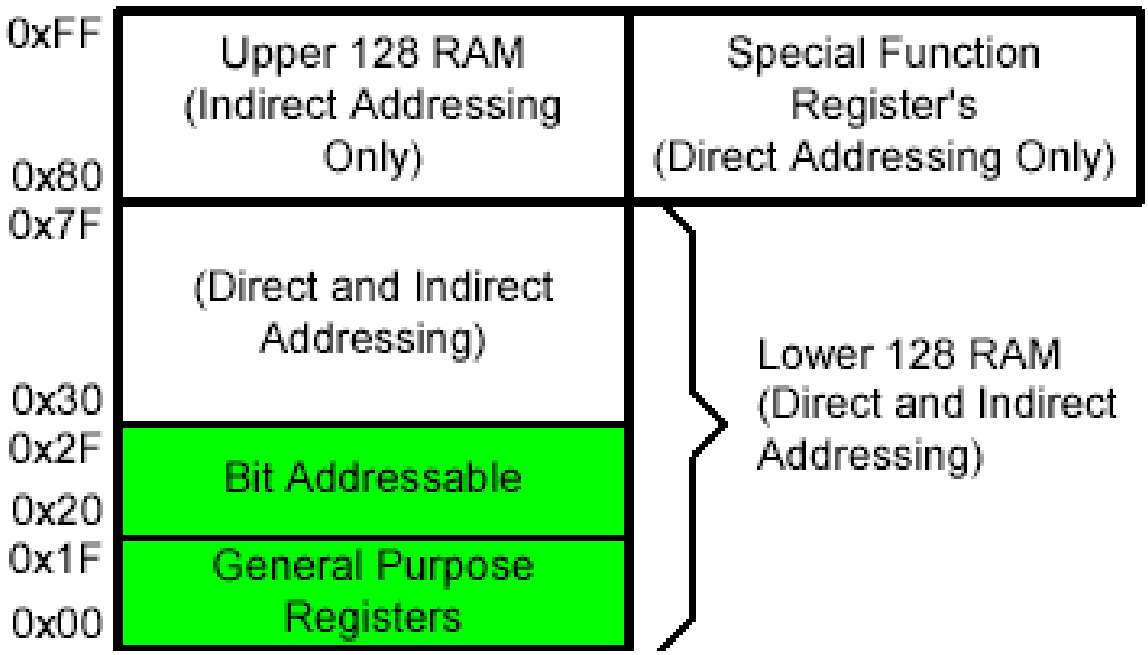
Block Diagram



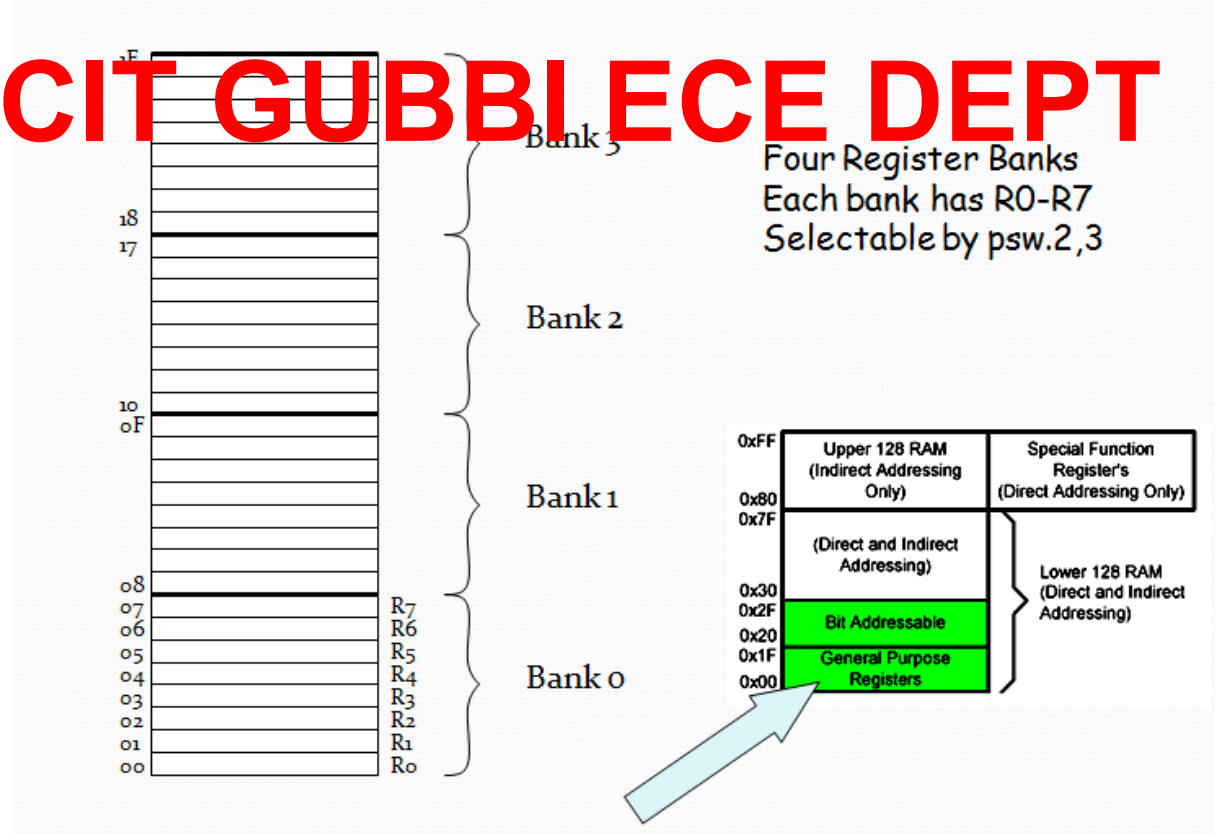


CIT GUBBI ECE DEPT

On-Chip Memory Internal RAM



Registers



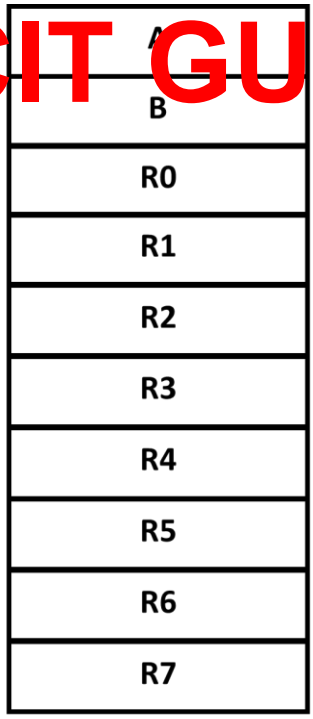
PSW: PROGRAM STATUS WORD. BIT ADDRESSABLE.

CY	AC	F0	RS1	RS0	OV	—	P

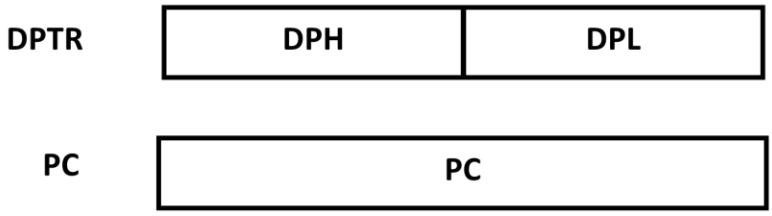
CY	PSW.7	Carry Flag.
AC	PSW.6	Auxiliary Carry Flag.
F0	PSW.5	Flag 0 available to the user for general purpose.
RS1	PSW.4	Register Bank selector bit 1 (SEE NOTE 1).
RS0	PSW.3	Register Bank selector bit 0 (SEE NOTE 1).
OV	PSW.2	Overflow Flag.
—	PSW.1	User definable flag.
P	PSW.0	Parity flag. Set/cleared by hardware each instruction cycle to indicate an odd/even number of '1' bits in the accumulator.

NOTE:
1. The value presented by RS0 and RS1 selects the corresponding register bank.

RS1	RS0	Register Bank	Address
0	0	0	00H-07H
0	1	1	08H-0FH
1	0	2	10H-17H
1	1	3	18H-1FH



Some 8-bit Registers of the 8051



Some 8051 16-bit Register

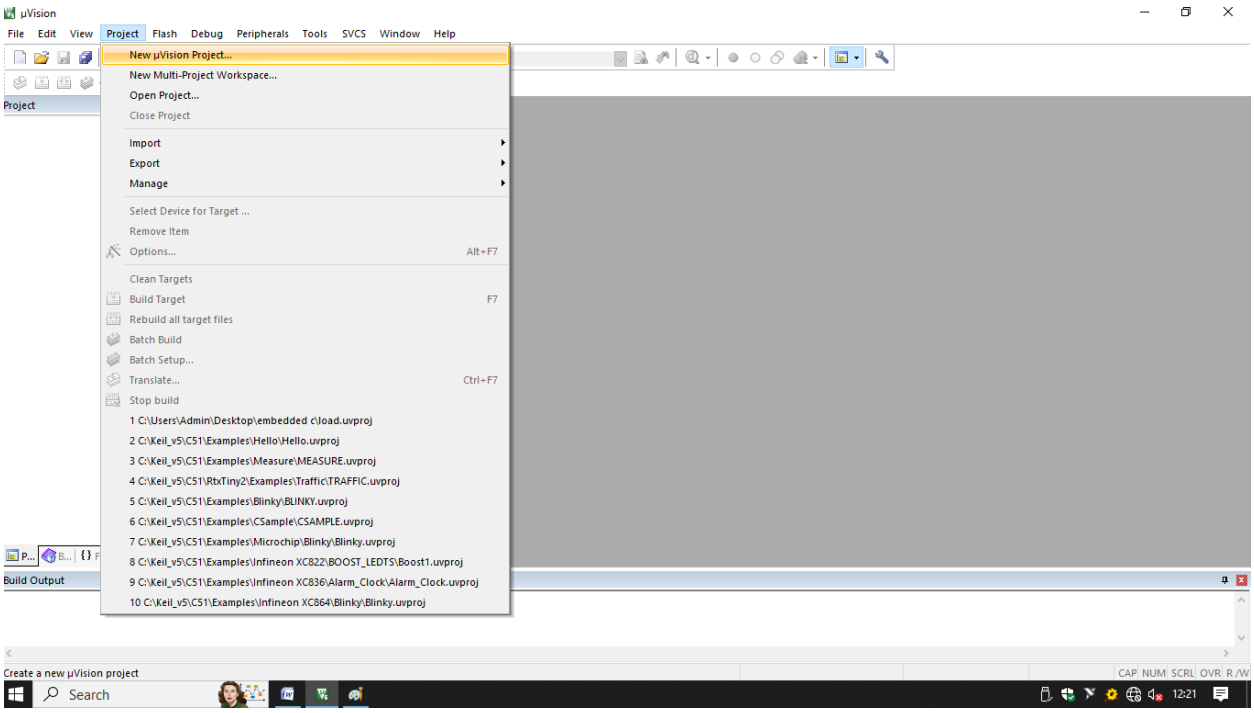
Data Types

Data types	Bits	Bytes	Value range
• Bit	1		0 to 1
• Signed char	8	1	-128 to +127
• Unsigned char	8	1	0 to 255
• enum	8\16	1\2	-128 to +127 or -32768 to +32767
• Signed short	16	2	-32768 to +32767
• Unsigned short	16	2	0 to 65535
• Signed int	16	2	-32768 to +32767
• Unsigned int	16	2	0 to 65535
• Signed long	32	4	-2147483648 to 2147483647
• Unsigned long	32	4	0 to 4294967295
• Float	32	4	±1.175494E-38 to ±3.402823E+38
• sbit	1		0 to 1
• sfr	8	1	0 to 255

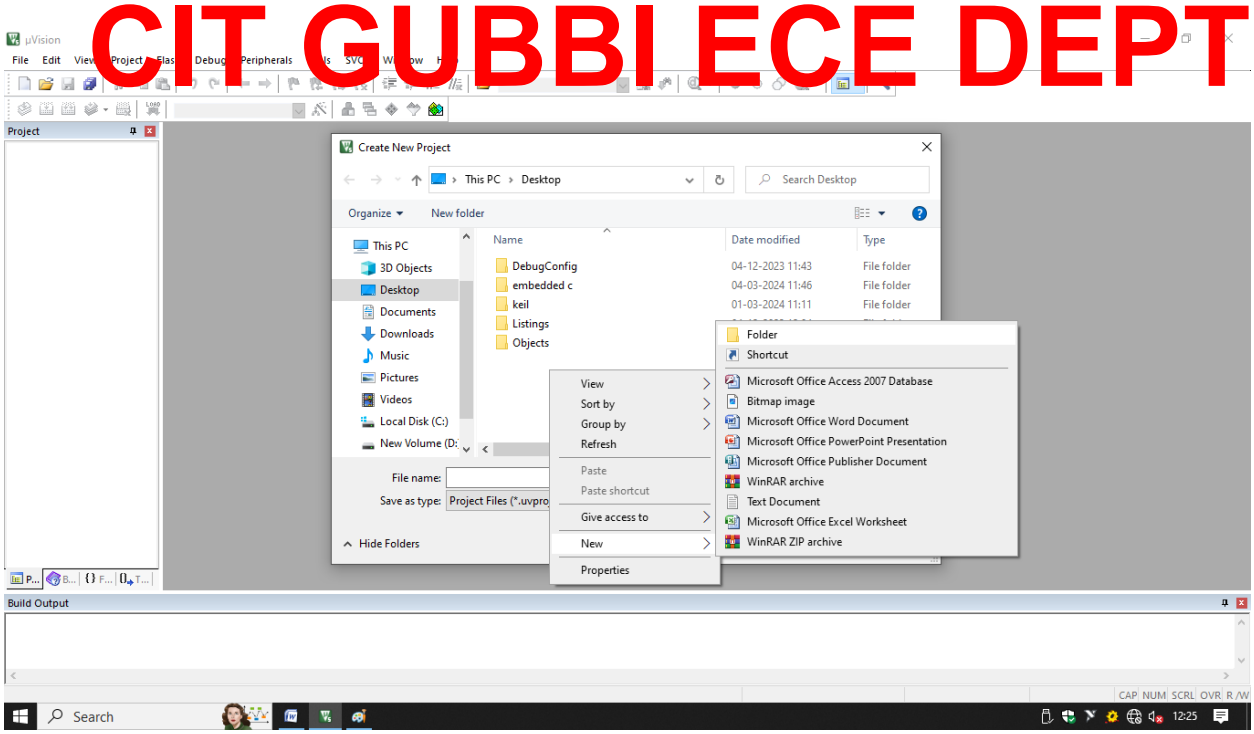
Note: The storage size may vary for data type depending on the cross compiler in use for embedded applications

Program execution Procedure

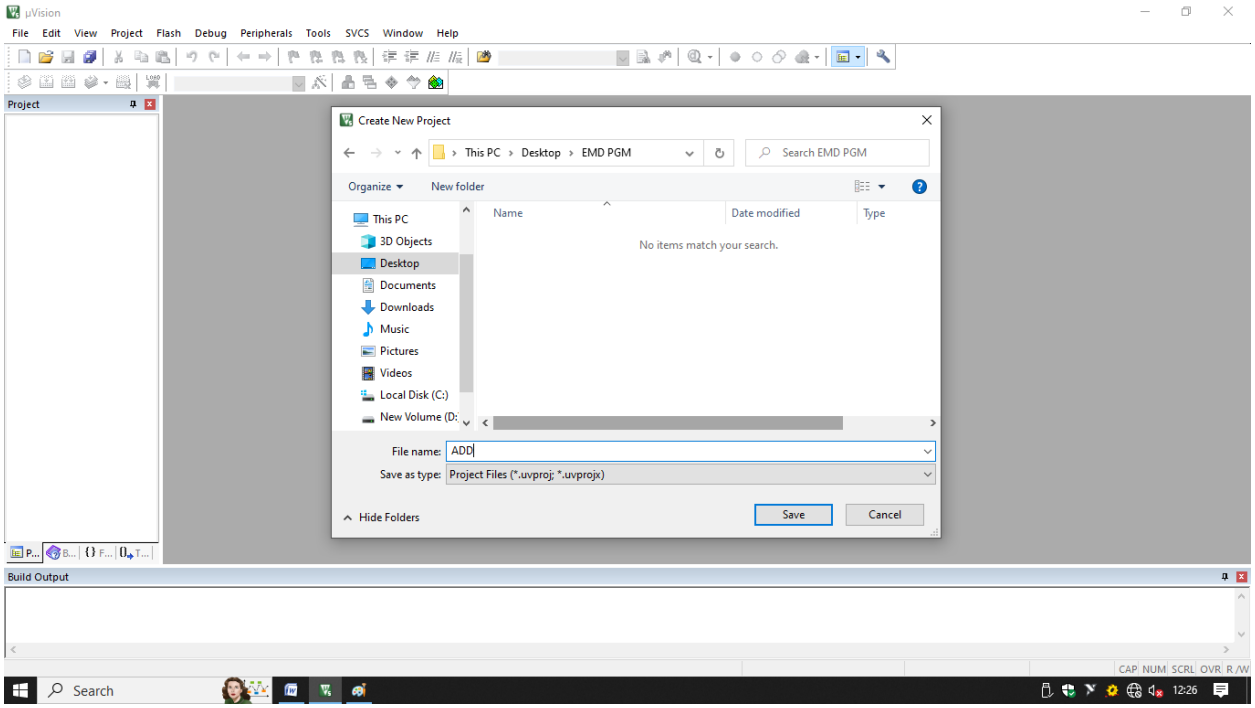
Step1: Double click Keil uVision5 icon, go to project and select create new uVision project.



Step2: Creating a new folder.

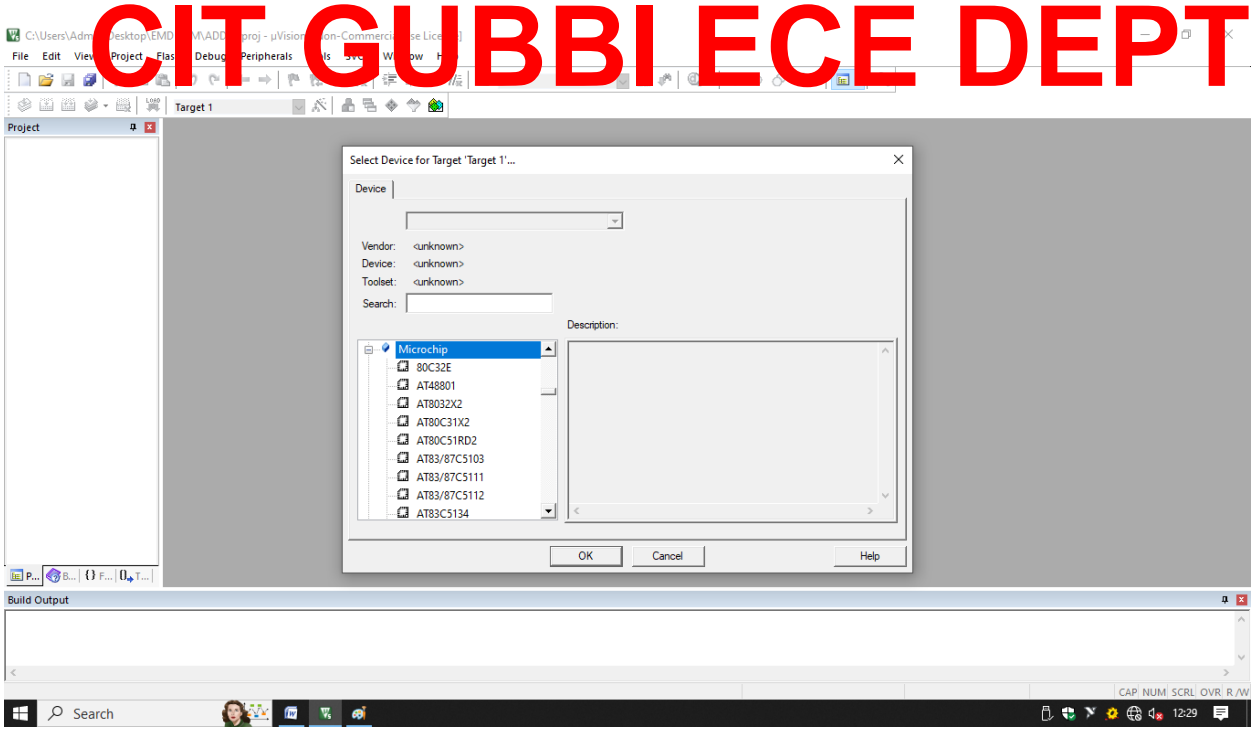


Step3: Creating a new file.

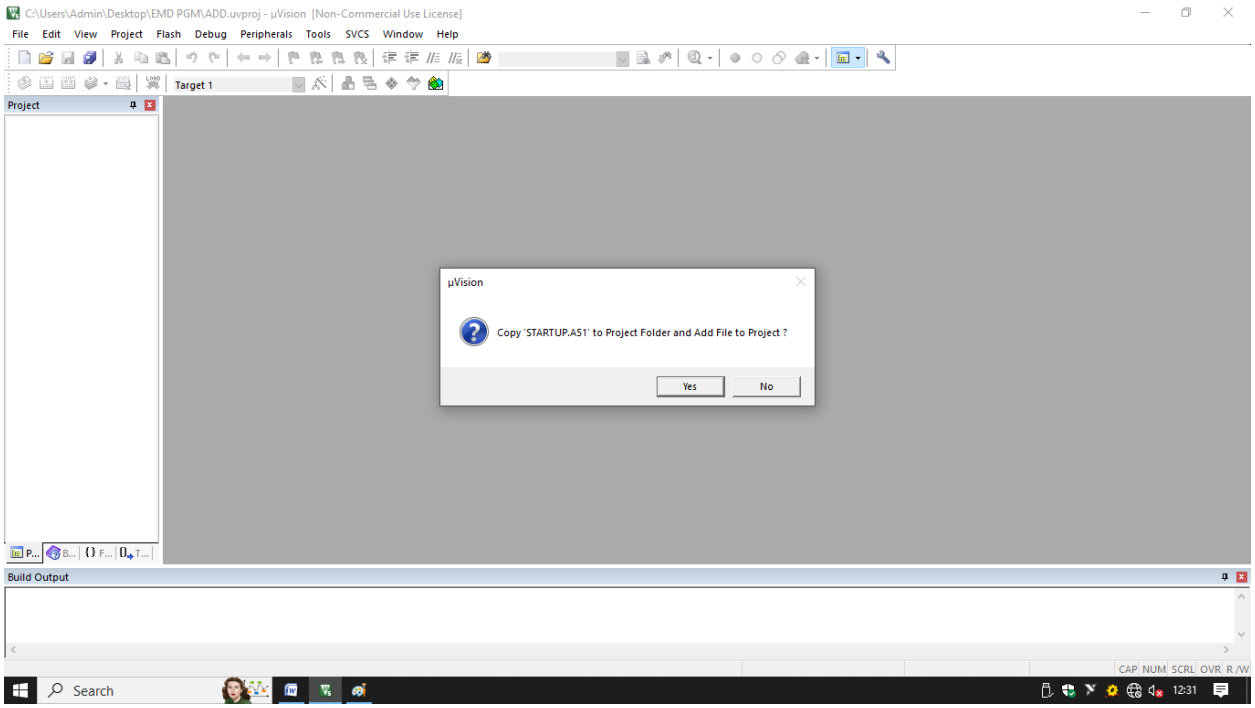


Step4: Selecting device.

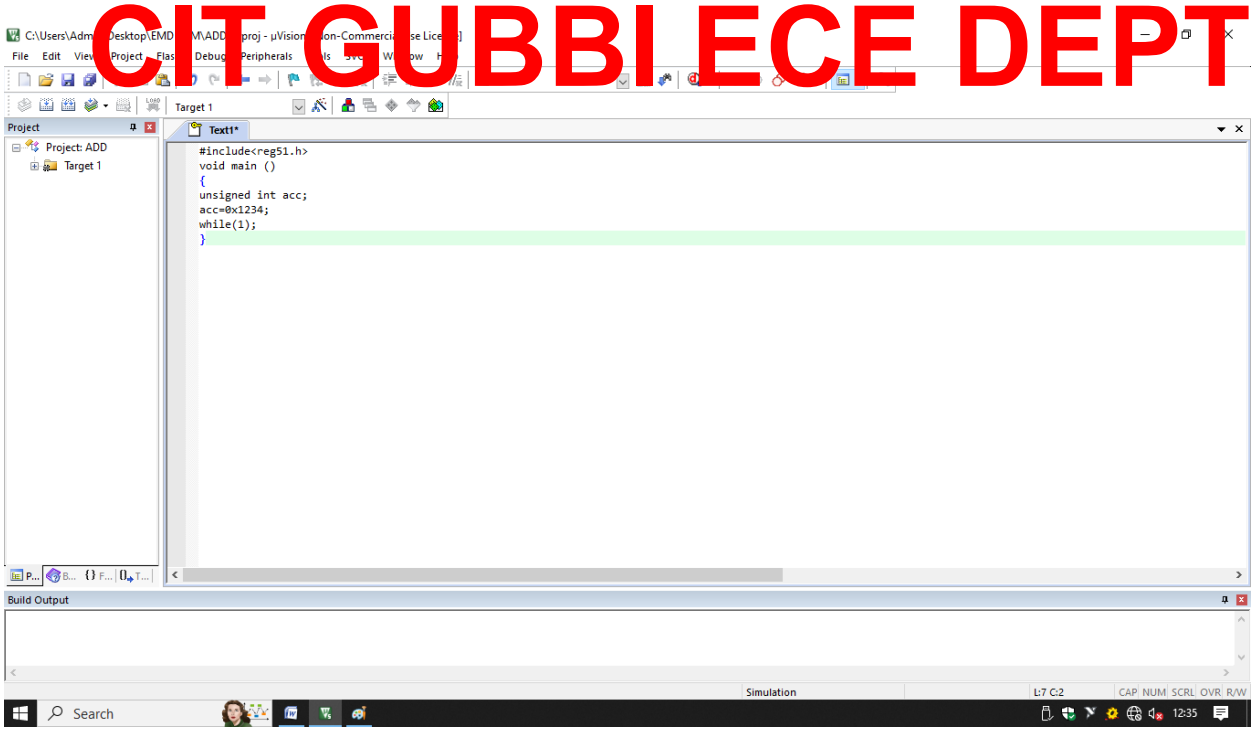
- Go to Microchip and select AT89C51 click ok.



Step5: Select option **NO.**

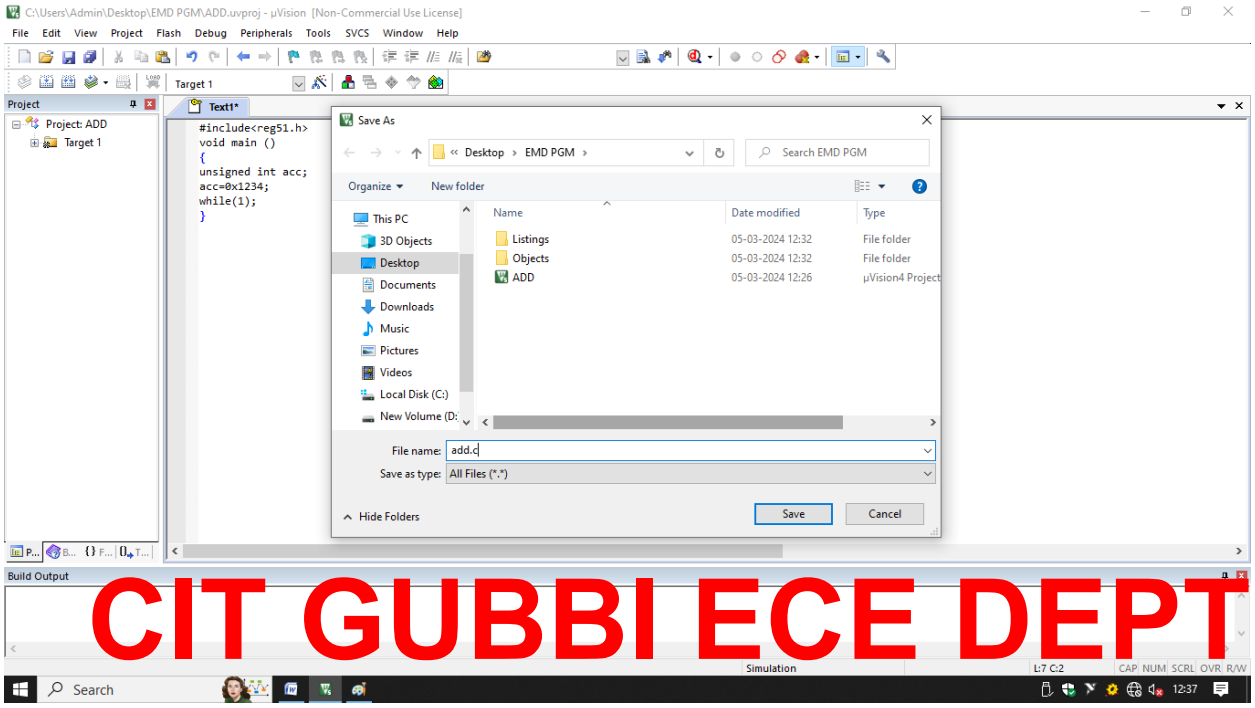


Step6: Write a code by selecting empty document.

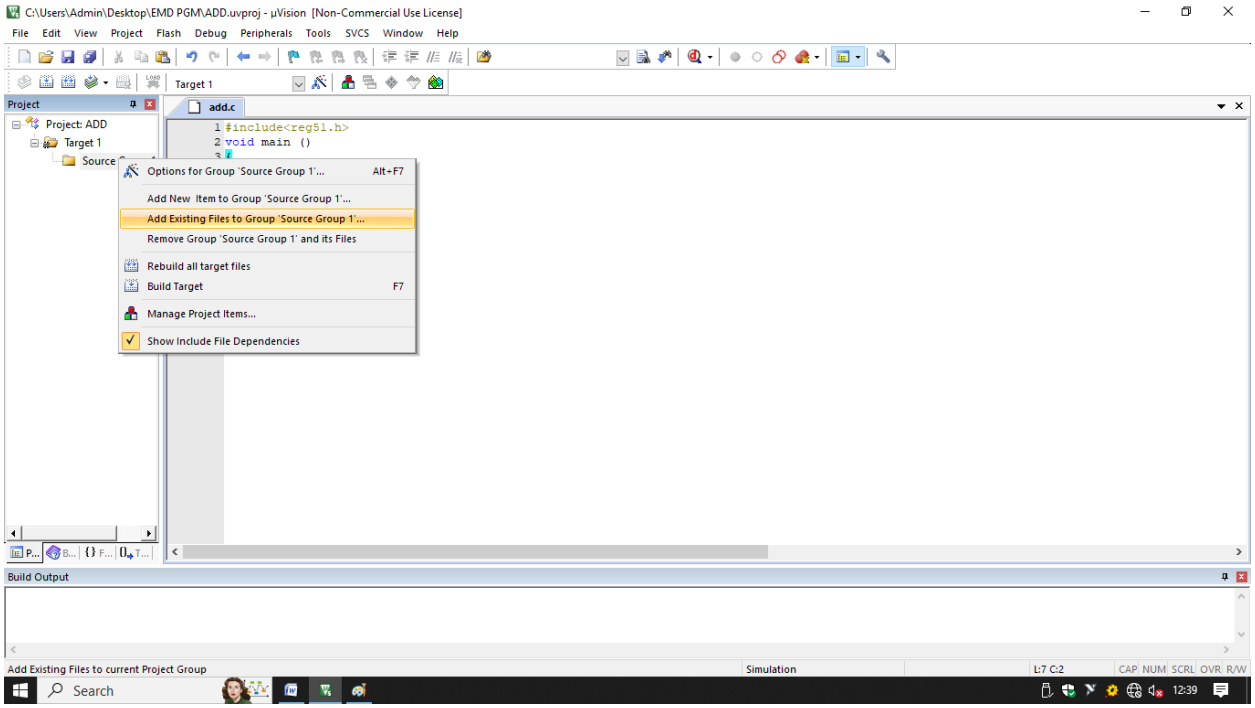


Step7: Save empty document in the form of document name.C **file.** (Eg:add.C)

For 8051 uc save empty document in the form of document name.asm file. (Eg:add.asm)

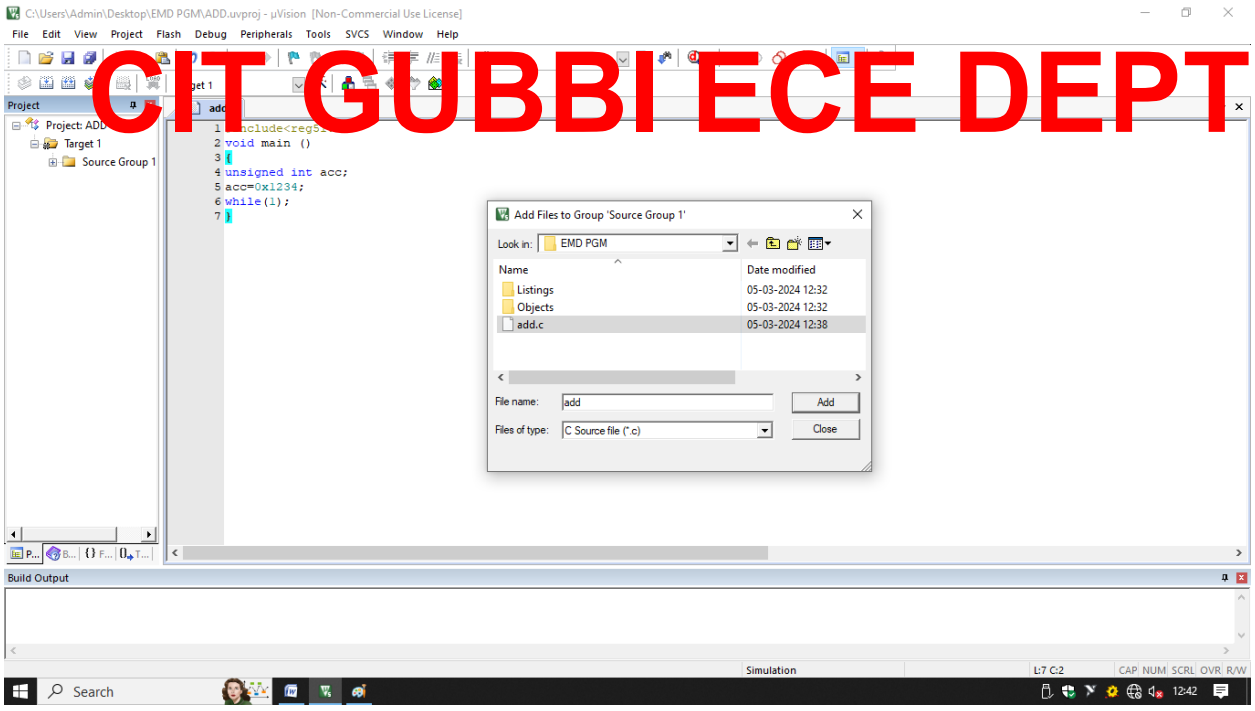


Step8: Go to Target in that select source group1.Right click source group1 and add existing file to group source group 1.

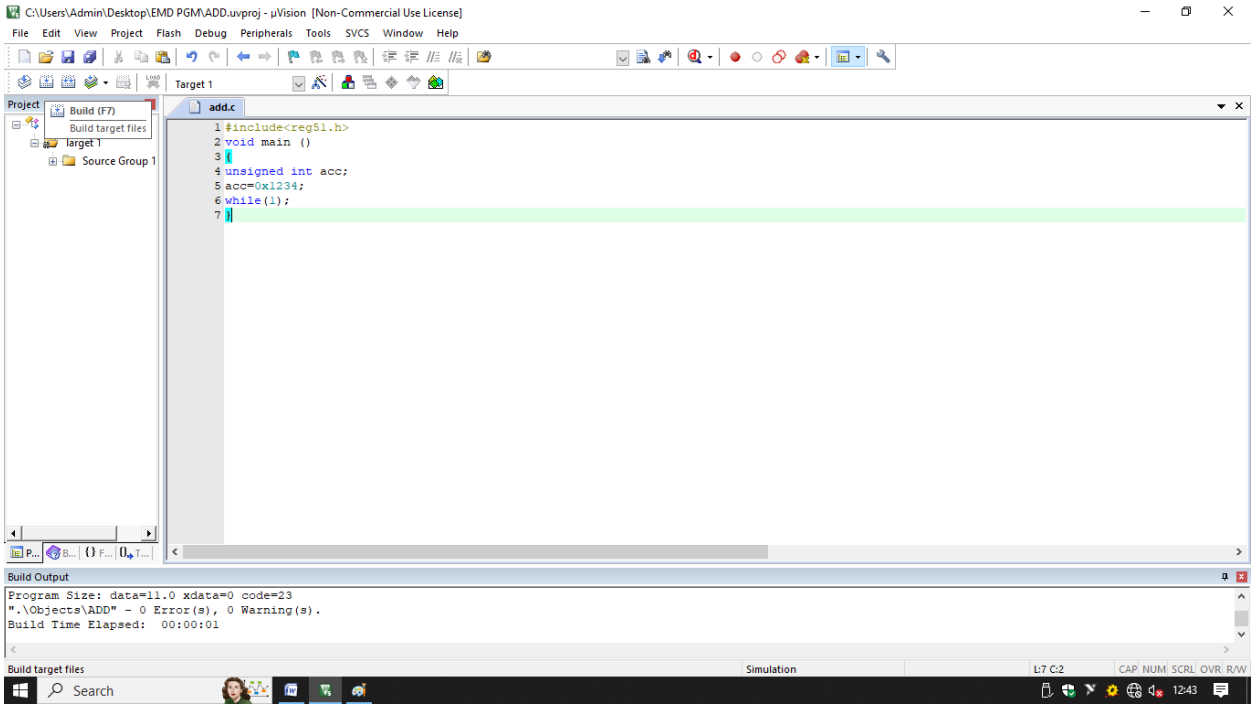


Step9: Selecting C file (Eg:Add.C) from source group1 add and close.

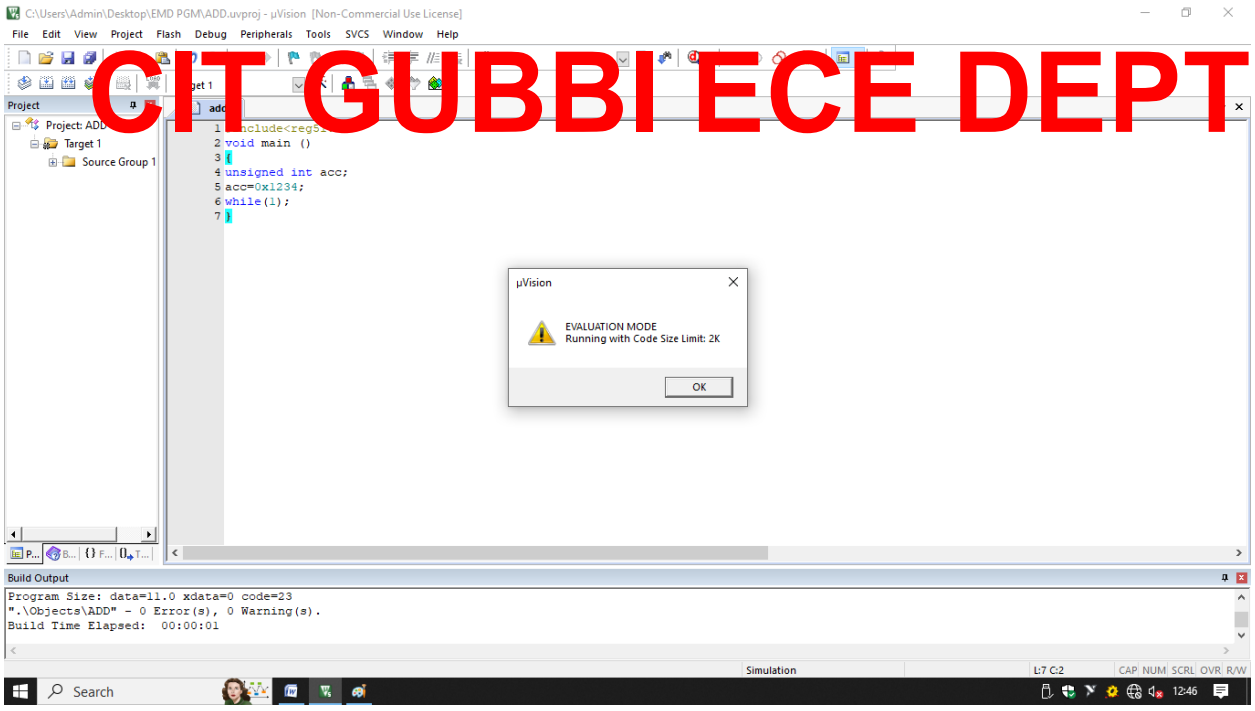
For 8051 uc Selecting asm file (Eg:Add.asm) from source group1 add and close.



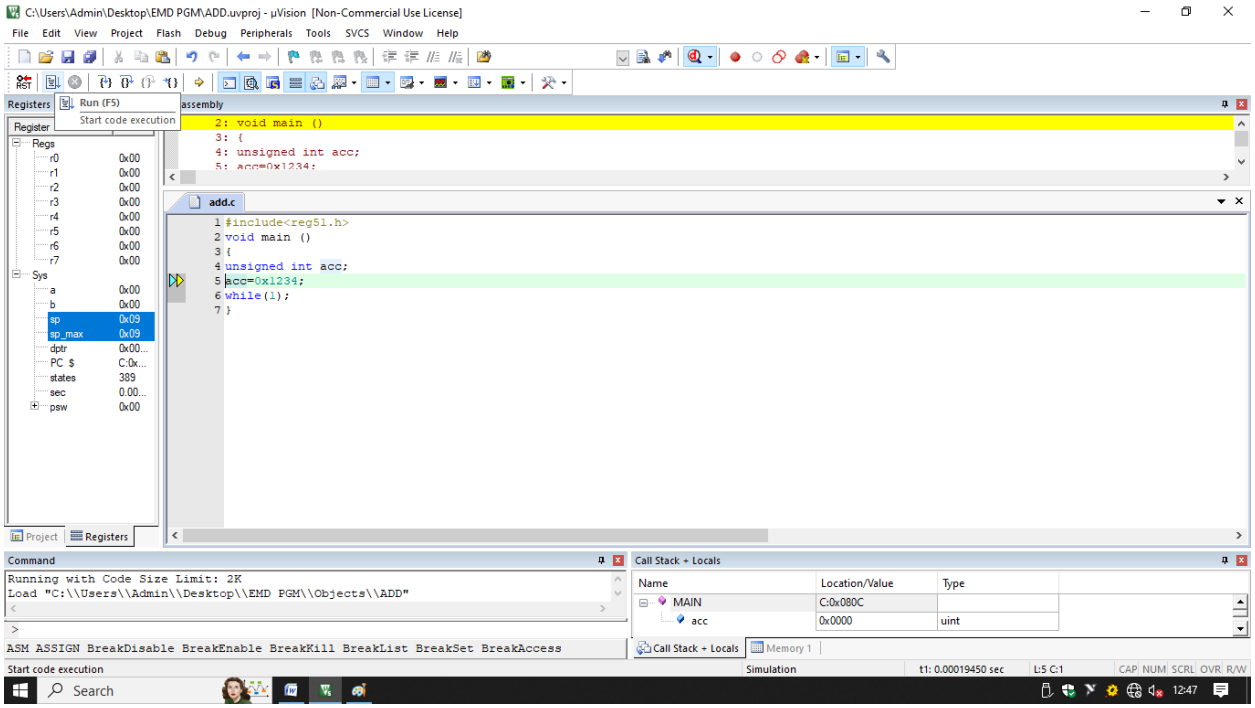
Step10: Save and Build the target file.



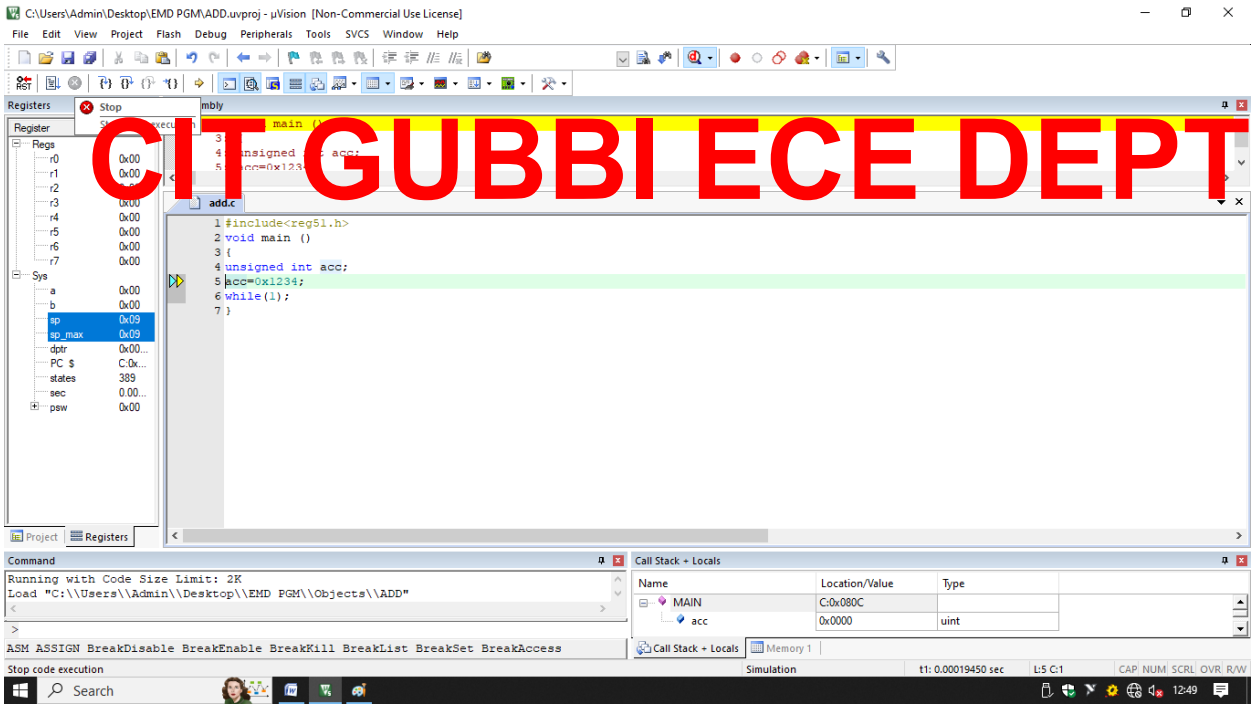
Step11: Debug the program by selecting debug icon and click ok.



Step12: Run the program by selecting run icon.



Step13: To check the results stop program by selecting stop icon.



Experiment No. 1 **Date:**

Write an ALP to move a block of 5data bytes from RAM locations 20H to 40H

```
ORG 00H
MOV R2,#5
MOV R0,#20H
MOV R1,#40H
UP: MOV A,@R0
 MOV @R1, A
INC R0
INC R1
DJNZ R2, UP
HERE: SJMP HERE
 END
```

Result:

Before execution: Go to memory window-1 type I:0x0020 and enter 01,02,03,04,05

After execution: go to memory window-2 type I:0x0040 and observe the data.

Experiment No. 2 **Date:**

Write an ALP to transfer 5 bytes of data from source 2000h to destination 2050h using external memory location

```
ORG 0000H
MOVDPTR,#2000H
MOV R0, #50H
MOV R2, #5

REPEAT:MOVXA,@DPTR
MOV @R0, A
INCDPTR
INC R0
DJNZR2,REPEAT

MOVDPTR,#2050H
MOV R0, #50H
MOV R2, #5

REPEAT1:MOVA,@R0 MOVX
@DPTR,A
INCDPTR
INC R0
DJNZR2,REPEAT1
HERE:SJMPHERE
END
```


Result:

Experiment No. 3 **Date:**

Write assembly language program to exchange 5 bytes of data at internal memory20H location to 40H location

```
ORG 0000H
MOV R0,#20H
MOV R1,#40H
MOV R2, #5
UP:MOV A,@R0
XCH A, @R1
MOV @R0, AINC
R0
INC R1
DJNZR2,UP
HERE:SJMPHERE
END
```

Result: CIT GUBBI ECE DEPT

Experiment No. 4 **Date:**

Write an ALP to exchange 5 bytes of data from external memory location 0000H with internal memory 10H location.

```
ORG 0000H
MOVDPTR,#0000H
MOV R0, #10H
MOV R2, #5

REPEAT:MOVXA,@DPTR XCH
A,@R0
MOVX@DPTR,A
INC DPTR
INCR0
DJNZ R2,REPEAT
HERE:SJMPHERE END
```

Experiment No.5 **Date:**

Write an ALP to add the byte in the RAM at 34h and 35h,store the result in the register R5 (LSB) and R6 (MSB), using Indirect Addressing Mode.

```
ORG 0000H
MOVR0,#34H
MOV A,@R0
INC R0
ADD A,@R0
MOV R5,A
JNC DOWN
MOV R6,#1
DOWN:NOP
HERE:SJMPHERE
END
```

Experiment No. 6 **Date:**

Write an ALP to subtract the bytes in Internal RAM 34h& 35h store the result in register R5 (LSB) & R6 (MSB).

```
ORG 0000H
MOV A,34H
SUBBA,35H
MOV R5,A
JNC DOWN
MOV R6,#1
DOWN:NOP
HERE:SJMPHERE
END
```

Experiment No. 7 **Date:**

Write an ALP to multiply two 8-bit numbers stored at 30h and 31h and store16- bit result in 32h and 33h of Internal RAM.

Program

```
ORG 0000H
MOVA,30H
MOVB,31H
MUL AB
MOV32H,A
MOV33H,B
HERE:SJMPHERE
END
```

Experiment No. 8 **Date:**

Write an ALP to perform division operation on 8-bit number by 8-bit number.

```
ORG 0000H
MOVA, 30H
MOVB, 31H
DIV AB
MOV32H, A
MOV33H, B
HERE: SJMP HERE
END
```

Experiment No. 9 **Date:**

Write an ALP to separate positive and negative in a given array

```
ORG 0000H
MOVDPTR,#1000H
MOV R0,#30H
MOVR1,#3AH
MOV R2,#05
UP:MOVXA,@DPTR
INC DPTR
RLCA
JBPSW.7,NEXT
RRC A
MOV@R0,A
INC
R0SJMPDO
WN
NEXT:RRCA
MOV  @R1,A
INC R1
DOWN:DJNZR2,UP
HERE: SJMP HERE
END
```

Experiment No. 10 **Date:**

Write an ALP to separate even or odd elements in a given array.

```
ORG 0000H
MOV DPTR,#1000H
MOV R0,#30H
MOVR1,#3AH
MOV R2,#05
UP:MOVXA,@DPTR
INC DPTR
RRC A
JBPSW.7,NEXT
RLC A
MOV@R0,A
INCR0
SJMP DOWN
NEXT:RLCA
MOV @R1,A INC R1
DOWN:DJNZ R2,UP
HERE: SJMP HERE
END
```

Experiment No. 11 **Date:**

Write an ALP to arrange the numbers in Ascending & Descending order.

```
ORG 0000H
MOVR2,#04H
OUTER:MOVR0,#40H
MOV A,R2
MOV R1,A
INNER:MOVA,@R0
INC R0
MOV B,@R0
CJNE A,B,NEXT
NEXT:JCDOWN
MOV @R0,A
DEC R0
MOV@R0,B
INC R0
DOWN:DJNZR1,INNER
DJNZ R2, OUTER
END
```

Experiment No. 12 **Date:**

Write an ALP to find Largest & Smallest number from a given array starting from 20h & store it in Internal Memory location 40h.

```
ORG 00H
MOVR3,#04H
MOVR0,#20H
MOVR1,#40H
MOV A,@R0
INC R0
UP:MOVB,@R0
CJNEA,B,NEXT
NEXT:JNC NOCARRY
MOV A,@R0
NOCARRY: INC R0
DJNZ R3,UP
MOV@R1,A
END
```

COUNTER OPERATION PROGRAMS

Experiment No. 13 **Date:**

Write an ALP for Decimal UP-Counter

```
ORG 0000H
MOVA,#00H
UP:ACALL DELAY
ADD A,#01H
DA A
JNZUP
HERE: SJMP HERE

DELAY:MOVR1,#0FFH
DECR1:MOV R2,#0FFH
DECR: MOV R3,#0FFH
HERE1:DJNZR3,HERE1
DJNZ R2,DECR
DJNZR1,DECR1
RET
END
```

Experiment No. 14 **Date:**

Write an ALP for Decimal DOWN-Counter

```
ORG 0000H
MOVA,#99H
UP:ACALLDELAY
ADD A,#99H
DA A
JNZUP
HERE: SJMP HERE

DELAY:MOVR1,#0FFH

DECR1:MOV R2,#0FFH
DECR: MOV R3,#0FFH
HERE1:DJNZR3,HERE1
DJNZ R2,DECR
DJNZR1,DECR1
RET
END
```

Experiment No. 15 **Date:**

Write an ALP for Hexadecimal UP-Counter.

```
ORG 0000H
MOVA,#00h
BACK:ACALLDELAY
INC A
JNZ BACK
HERE: SJMP HERE

DELAY:MOVR1,#0FFH
DECR1:MOV R2,#0FFH
DECR: MOV R3,#0FFH
HERE1:DJNZR3,HERE1
DJNZ R2,DECR
DJNZR1,DECR1
RET
END
```

Experiment No. 16 **Date:**

Write an ALP for Hexadecimal DOWN-Counter.

```
ORG 0000H
MOVA,#0FFh
BACK:ACALLDELAY
DEC A
JNZBACK
HERE: SJMP HERE

DELAY:MOVR1,#0FFH
DECR1:MOV R2,#0FFH
DECR: MOV R3,#0FFH
HERE1:DJNZR3,HERE1
DJNZ R2,DECR
DJNZR1,DECR1
RET
END
```

PART-II

C PROGRAMMING

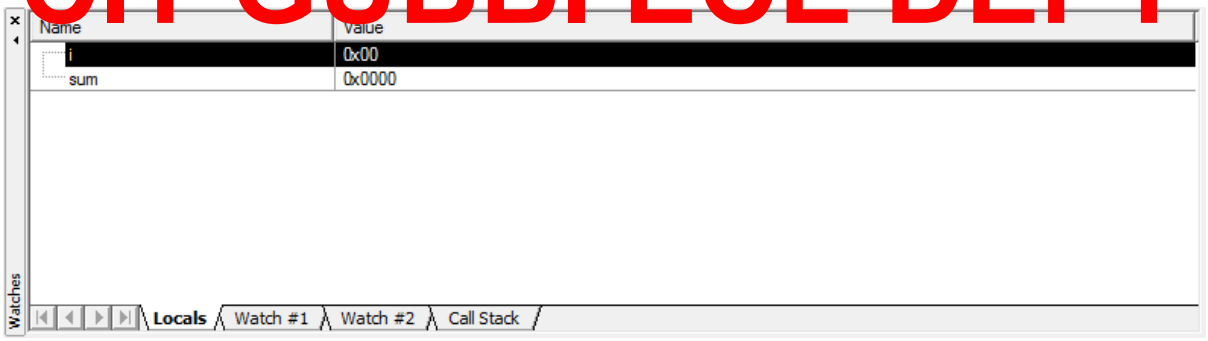
Experiment No. 17 **Date:**

Write an 8051 C program to find the sum of first 10 integer numbers.

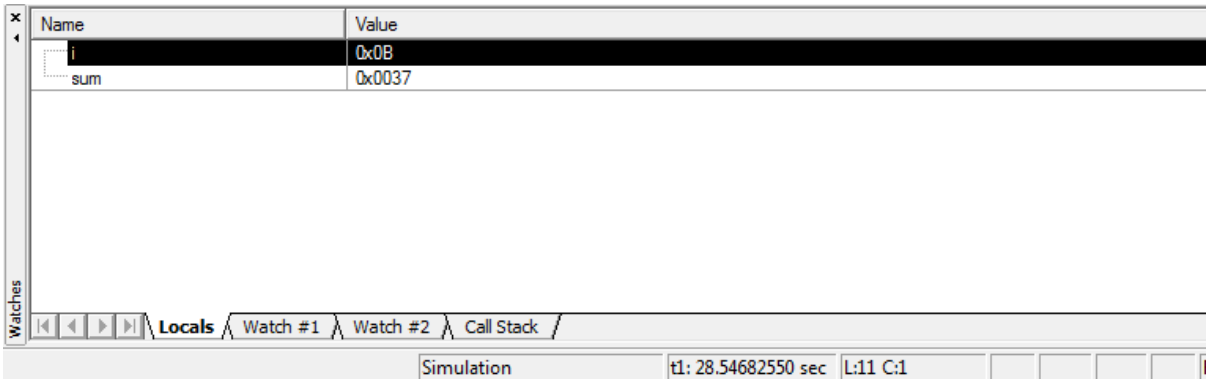
```
#include <reg51.h>
void main ( )
{
unsigned char i;
unsigned int  sum=0;
for(i=1;i<=10;i++)
{
sum=sum+i;
}
P0=sum;
while(1);
}
```

Result:

Before execution



After execution



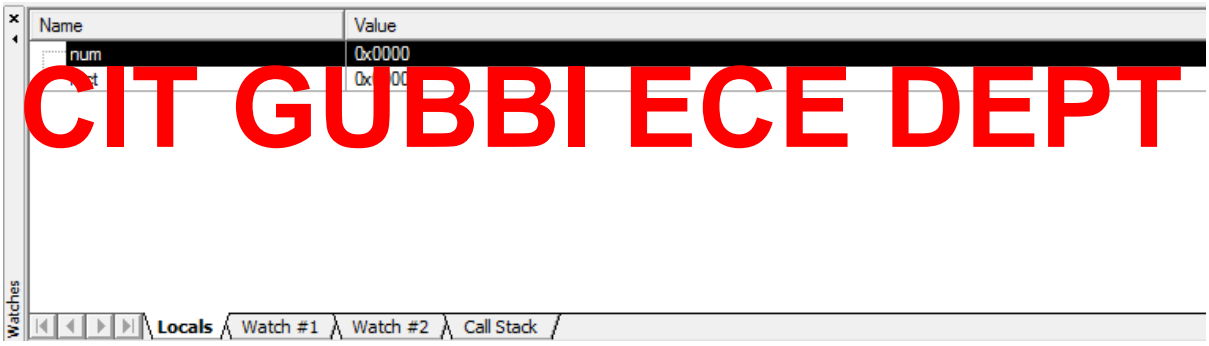
Experiment No. 18 **Date:**

Write an 8051 C program to find factorial of a given number.

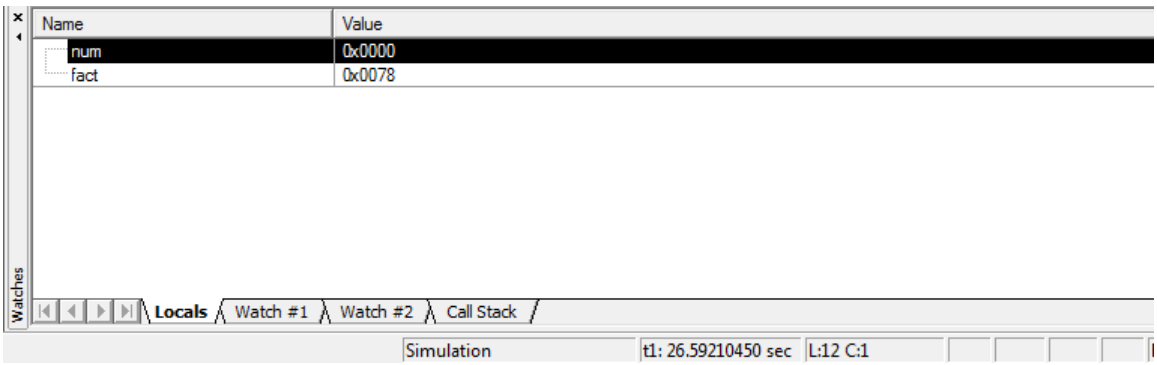
```
#include <reg51.h>
void main()
{
 unsigned int num=5,fact=1;
 while(num>0)
  {
 fact=fact*num;
 num--;
   }
   P1=fact;
   while(1);
}
```

Result

Before execution



After execution



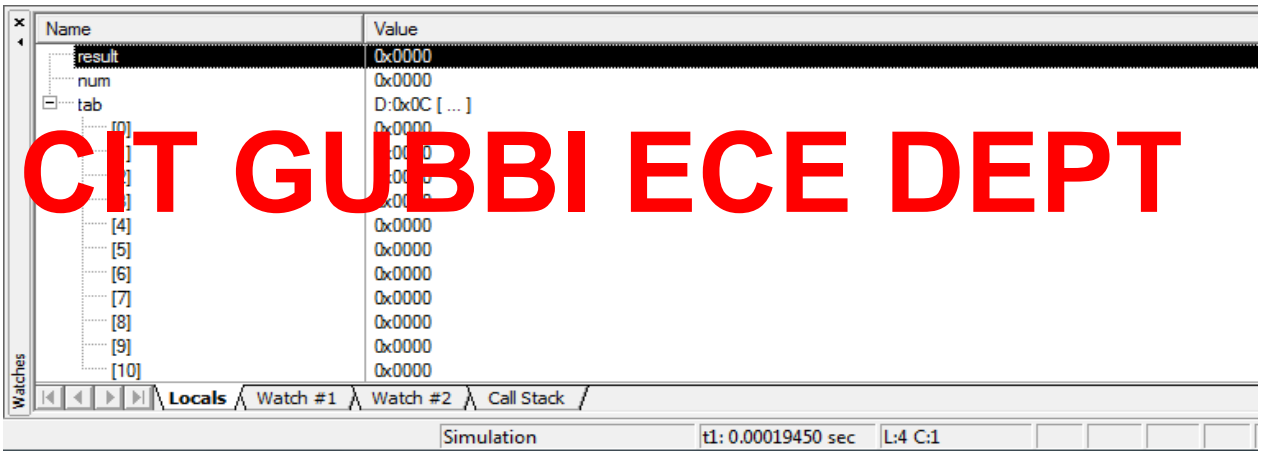
Experiment No. 19 **Date:**

Write an 8051C program to find the square of a number (1to10) using look-up table.

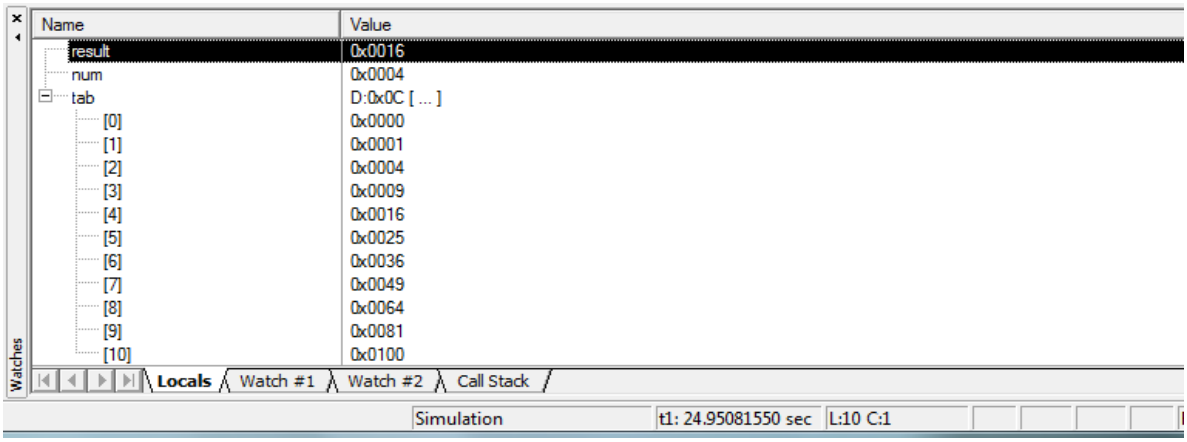
```
#include <reg51.h>
void main ( )
{
unsigned int result, num=4;
unsigned int tab[]={0x0,0x1,0x4,0x9,0x16,0x25,0x36,0x49,0x64,0x81,0x100};
if(num<10)
result =tab[num];
else
result=0;
while(1);
}
```

Result:

Before execution



After execution



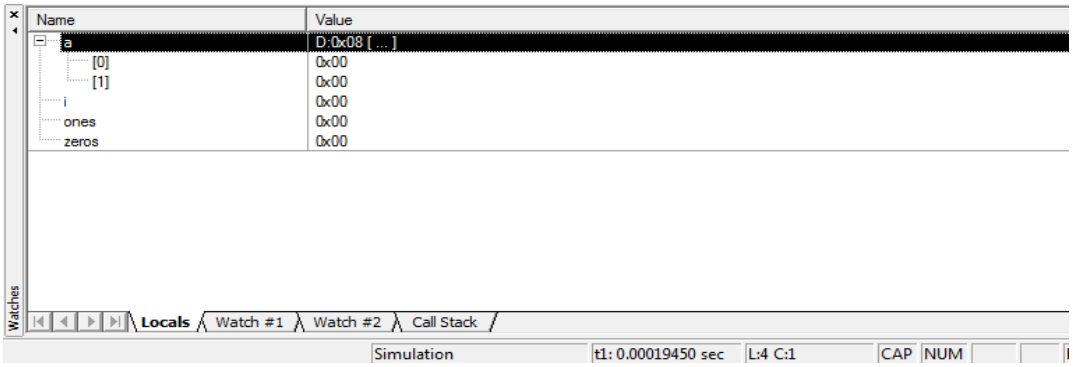
Experiment No. 20 **Date:**

Write an 8051 C program to count the number of ones and zeros in two consecutive memory locations.

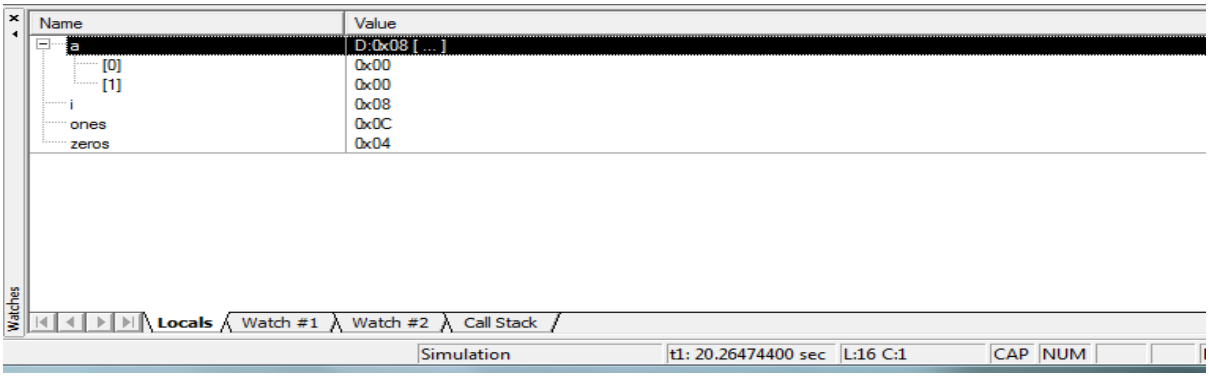
```
#include <reg51.h>
void main ( )
{
unsigned char a[]={0xfa,0xfa},i;
unsigned char ones, zeros;
CY=0;
for(i=0;i<8;i++)
{
a[0]>>=1;
if(CY==1) ones++;
else zeros++;
a[1]>>=1;
if(CY==1) ones++;
else zeros++;
}
while(1);
}
```


Result:

Before execution



After execution



PART-III

HARDWARE INTERFACE PROGRAMS

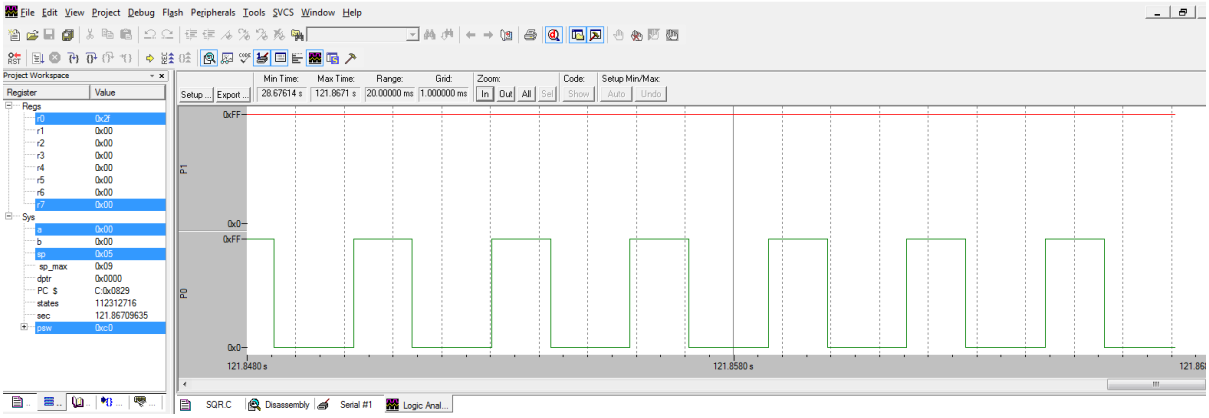
Experiment No. 21 **Date:**

Write an 8051C program to generate the square, using DAQ.

```
#include <reg51.h>
void delay(unsigned int x)
{
 for(;x>0;x--);
}
main()
{
 unsigned char on=0xff,off=0x00;
P0=on;
 delay(100);
P0=off;
 delay(100);
}
```


Result:

After execution



Write an 8051C program to rotate motor in clock and anti-clockwise direction

SINE WAVE:

```
#include<reg51.h>
main()
{
Unsigned char
a[]={128,192,238,255,238,192,128,64,17,0,
17, 64};
int  i;
while(1)
{
for(i=0;i<12;i++)
P0=a[i];
}}
```

Experiment No. 22 **Date:**

Write an 8051C program to rotate motor in clock and anti-clockwise direction

CLOCKWISEROTATION

```
#include<reg51.h>
Void delay(unsigned int x)
{
for(;x>0;x--);
}
main()
{
Unsigned char val ,i;
while(1)
{
val=0x88;
for(i=0;i<4;i++)
{
P2=val;
val=val>>1;
delay(575);
}}}
```

CLOCKWISEROTATION (ANOTHER TYPE)

```
#include<reg51.h>
Void delay(unsigned int x)
{
for(;x>0;x--);
}
main()
{
Unsigned char val;
while(1)
{
val=0x03;
P2=val;
delay(5750);
val=0x09;
P2=val;
delay(5750);
val=0x0c;
P2=val;
delay(5750);
val=0x06;
P2=val;
delay(5750);
}}
```

ANTICOLCKWISE ROTATION

```
#include<reg51.h>
Void delay(unsigned int x)
{
for(;x>0;x--);
}
main()
{
Unsigned char val ,i,j,k;
while(1)
{
for(i=0;i<0x19;i++)
{
val=0x88;
for(j=0;j<4;j++)
{
P2=val;
val=val>>1;
delay(1000);
}}
for(k=0;k<0x32;k++)
{
val=0x11;
for(j=0;j<4;j++)
{
P2=val;
val=val<<1;
delay(1000);
}}}}
```