

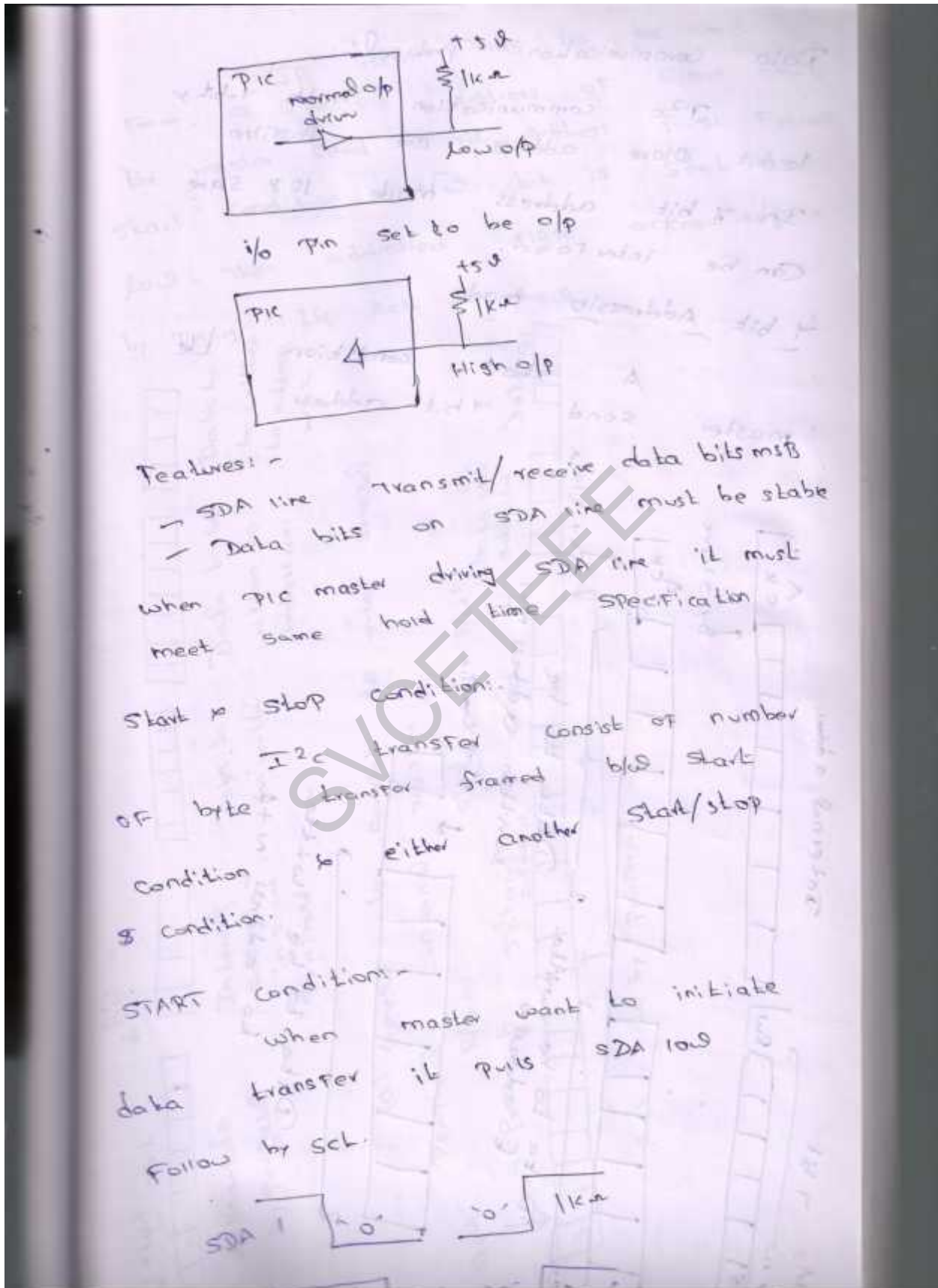
Bus Rate:-

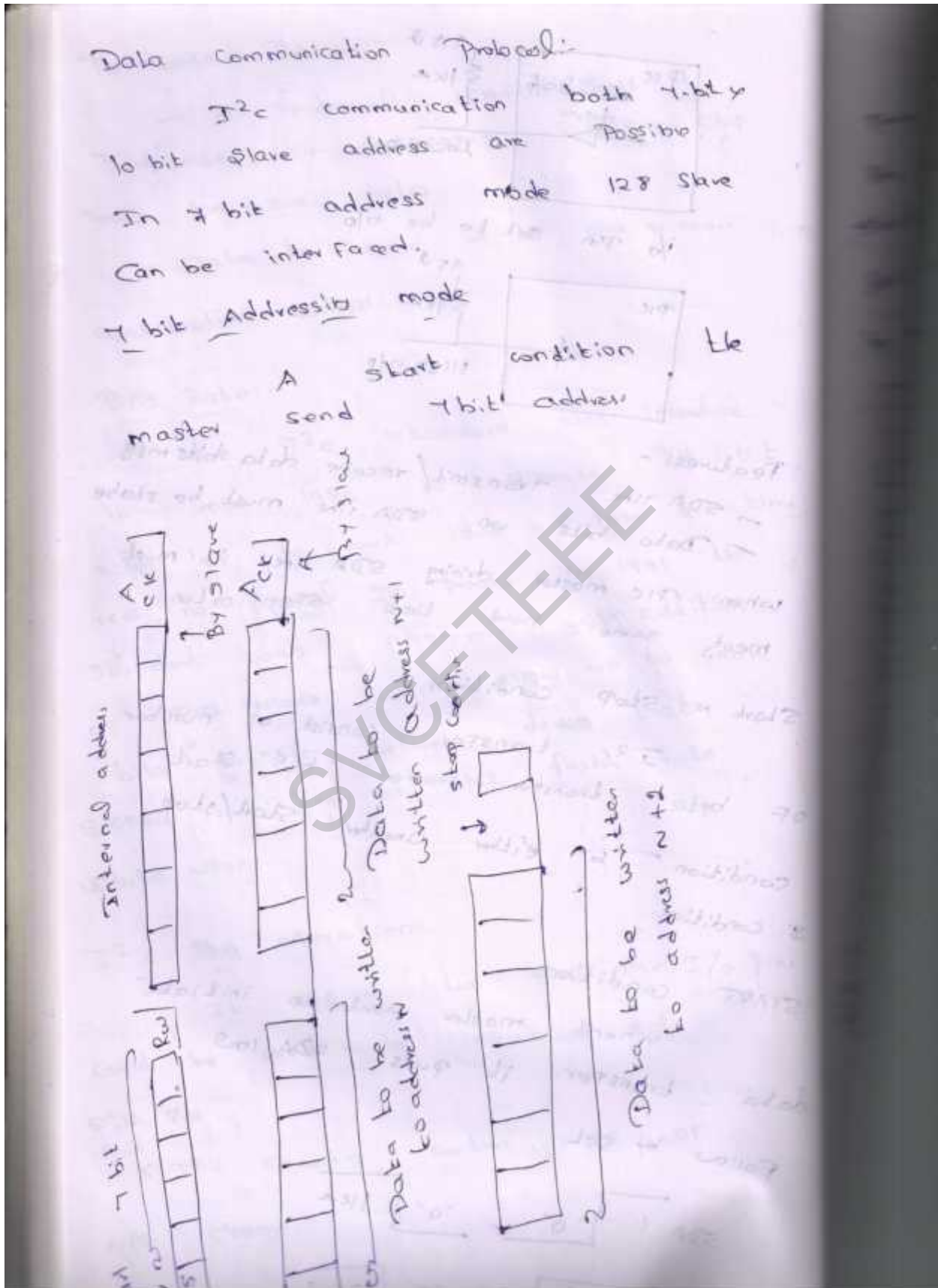
The I²c standard was introduced in mid 1980 to operate at bit rate up to 100 kbits a rate at time req no special IC process. In 1995 the standard was augmented with addition of Fast mode which allow up to 400 kbits transfer between devices that support it. Even at this faster rate,

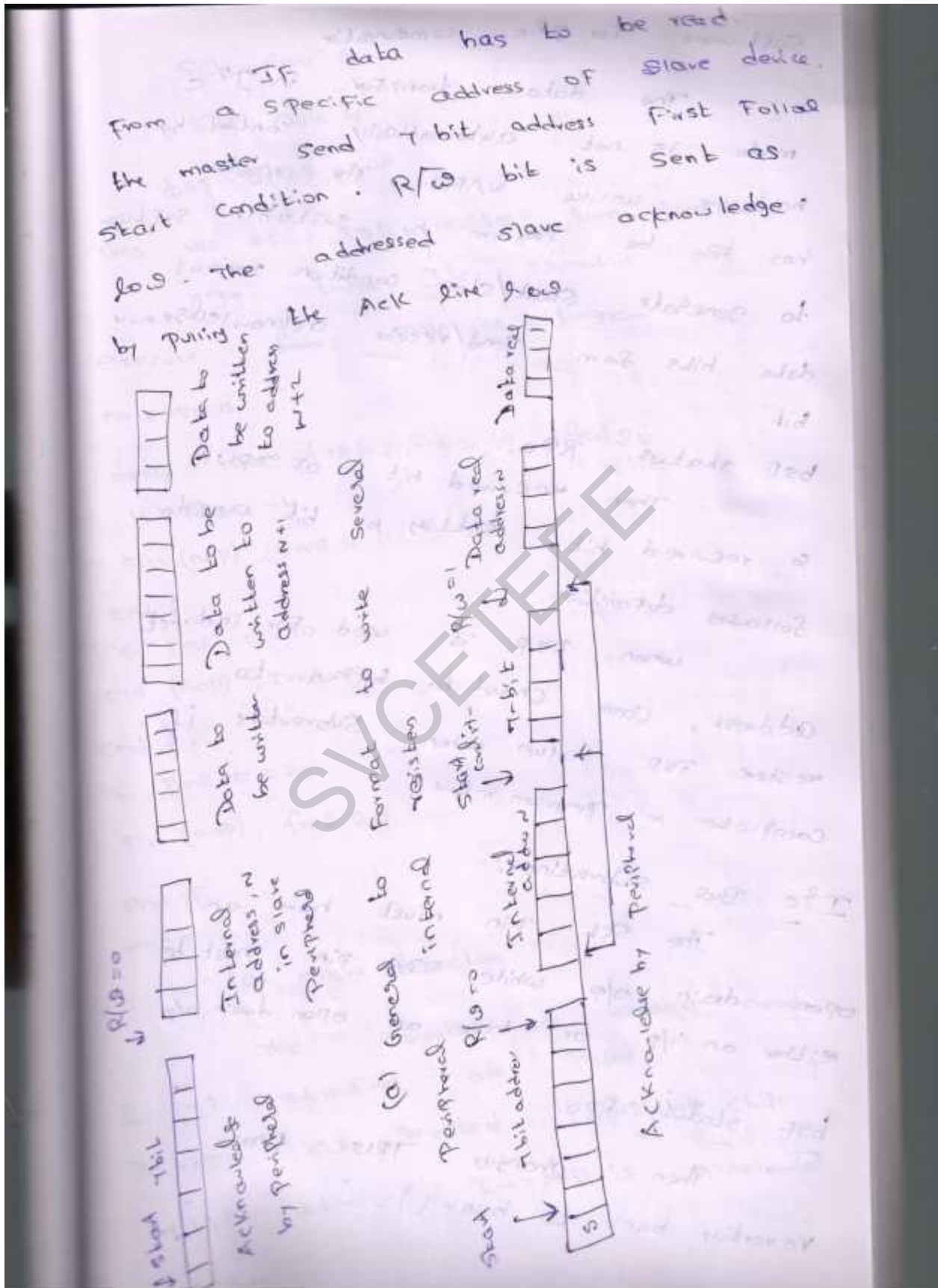


I²c Bus operation:-

It require two open drain I/O pins could be used to implement scl to SDA pin. * I²c circuitry control size of o/p charge.







Software For I2C communication

The data transfer in I2C mode is not automatically control by hardware unlike UART. The master has to be program by suitable software to generate start/stop condition. various data bits from send/receive acknowledge bit bsf status, RPO:-

Then received bit of TRISA
 & received bit - setting a bit consider
 follows definition

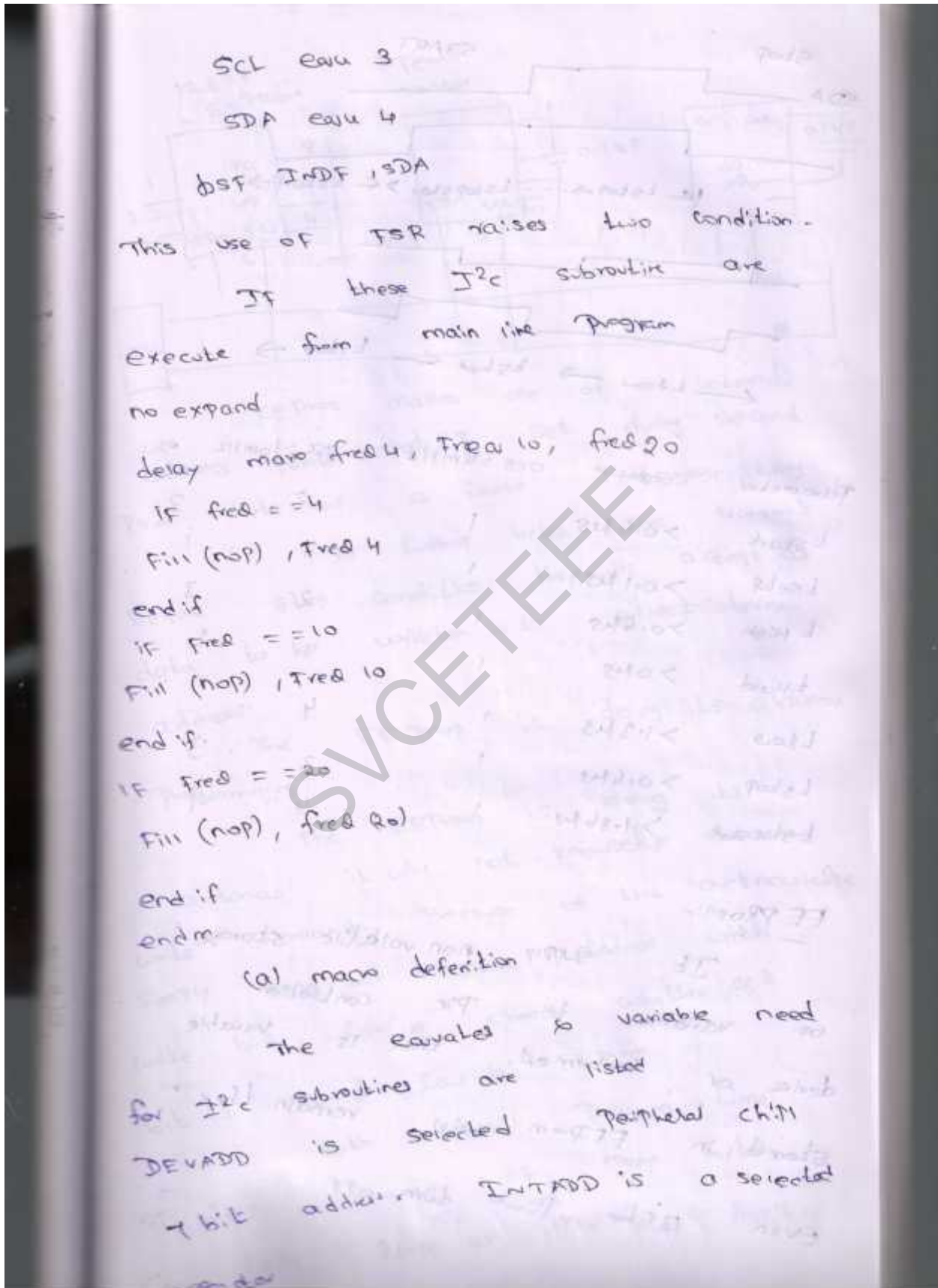
when FSR is used for indirect address, care should be taken to restore FSR value when subroutine is complete & program return

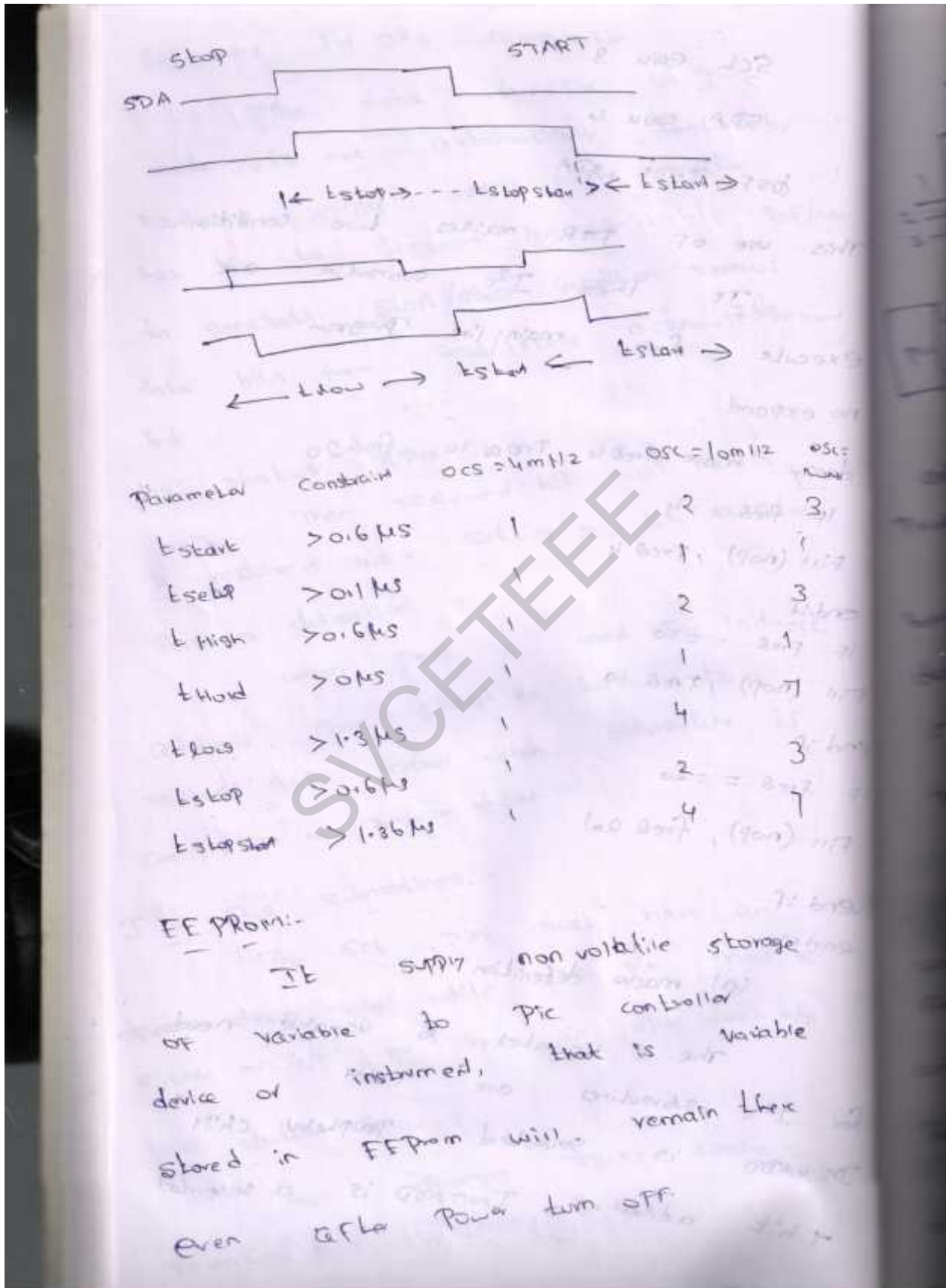
I2C Bus subroutines:-

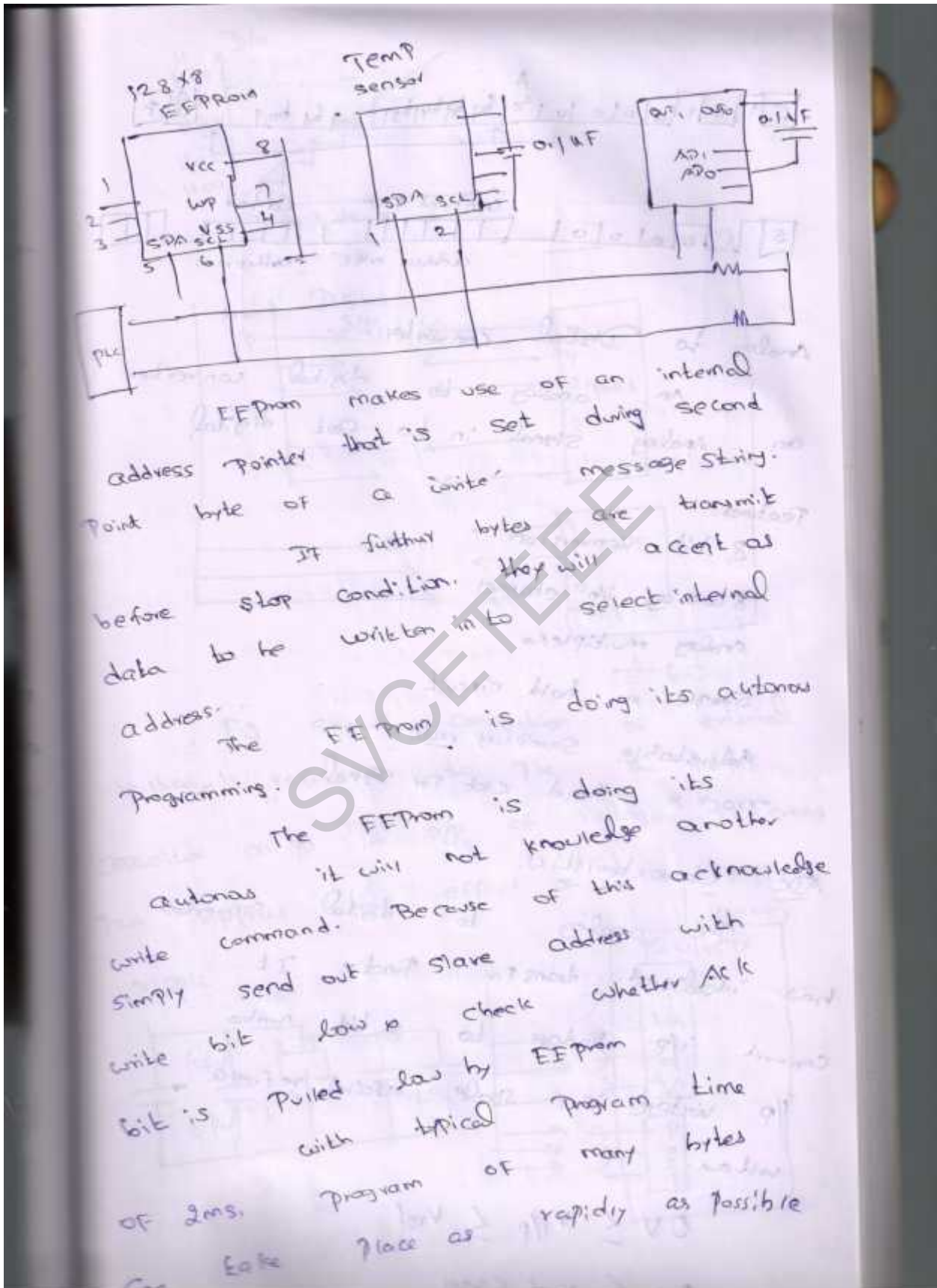
The SCL pin must have an open drain o/p while SDA pin must be either an i/p or have an open drain o/p

bsf status, RPO:-

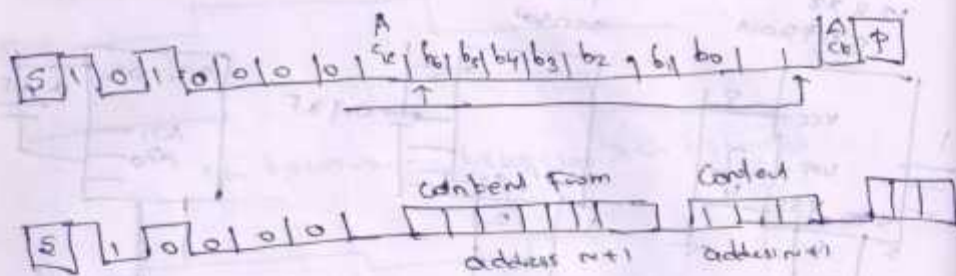
Then change TRISC finally
 reverting back to bank ()







EEPROM makes use of an internal address pointer that is set during second point byte of a write message string. If further bytes are transmitted before stop condition, they will accept as data to be written into select internal address. The EEPROM is doing its autonomous programming. The EEPROM is doing its autonomous write command. Because of this it will not acknowledge another simply send out slave address with write bit low to check whether ACK bit is pulled low by EEPROM with typical program time of 2ms. Program of many bytes can take place as rapidly as possible.



Analog to Digital Converter:-

An analog to digital converter
 an analog signal in to out digital

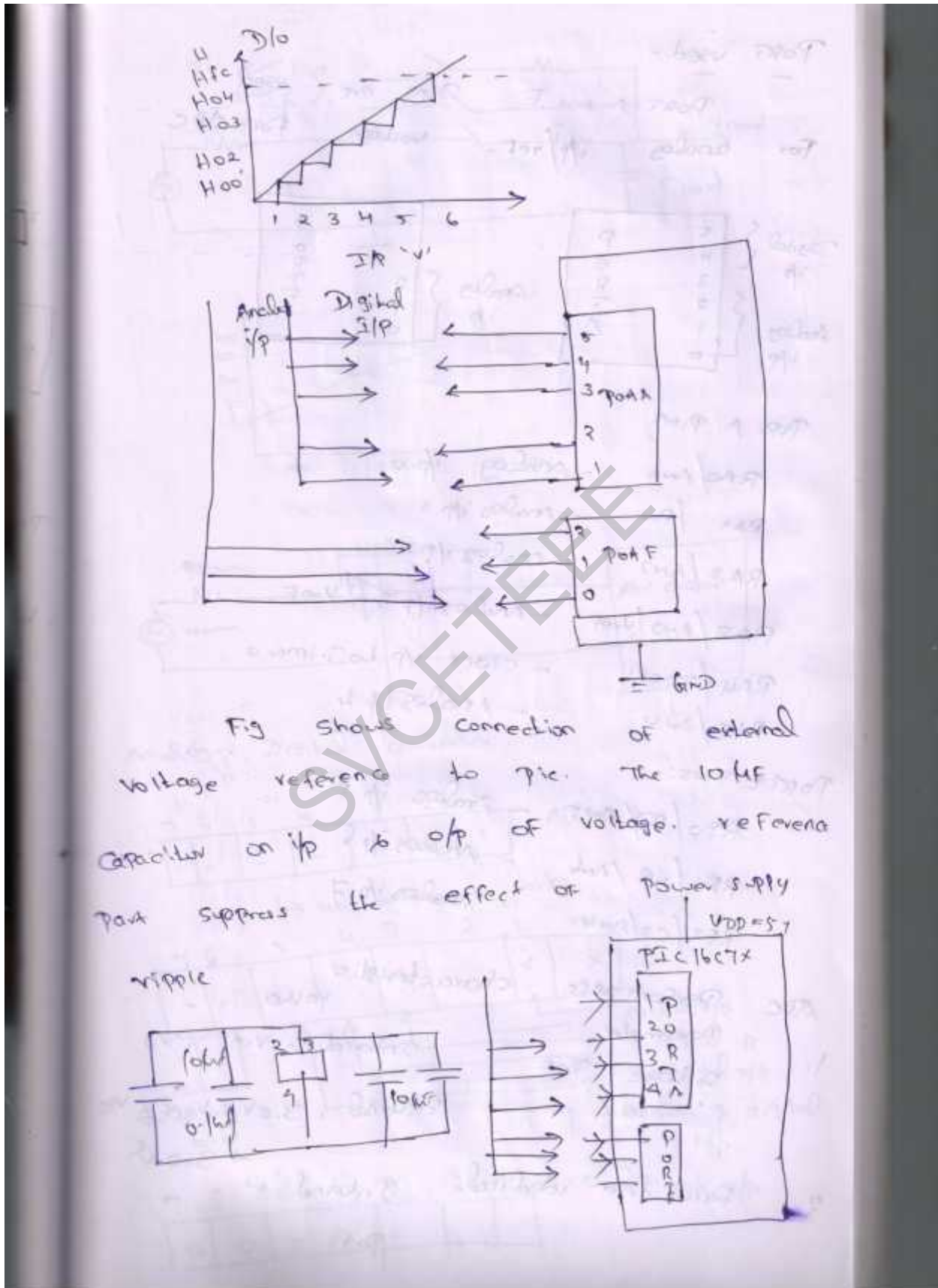
Features:-

- 8 bit Conversion
- 8 analog i/p channel
- Analog multiplexer
- Sample & hold circuit
- Adjustable Sampling rate
- Track & hold ckt for signal

ADC Characteristics:

Pic analog to digital converter
 has idealized transfer function. It
 convert i/p voltage to 8 bit number
 i/p voltage is scale against reference
 voltage.

$$0V \leq V_{i/p} \leq V_{ref}$$



PORT used:-

PORT A to E pins are used for analog i/p/ref. voltage For ADC

PORT A PINS

- RA0/AN0 - Analog i/p 0
- RA1/AN1 - Analog i/p 1
- RA2/AN2 - Analog i/p 2
- RA3/AN3/Vref - Analog i/p 3 / Vref
- RA4/T0CK1 - Clock i/p to timer 0
- RA5/AN4 - Analog i/p 4

PORT E PINS:-

- RE0/RD/AN5 - Analog i/p 5
- RE1/WR/AN6 - Analog i/p 6
- RE2/CS/AN4 - Analog i/p 7

ADC Performance characteristics value

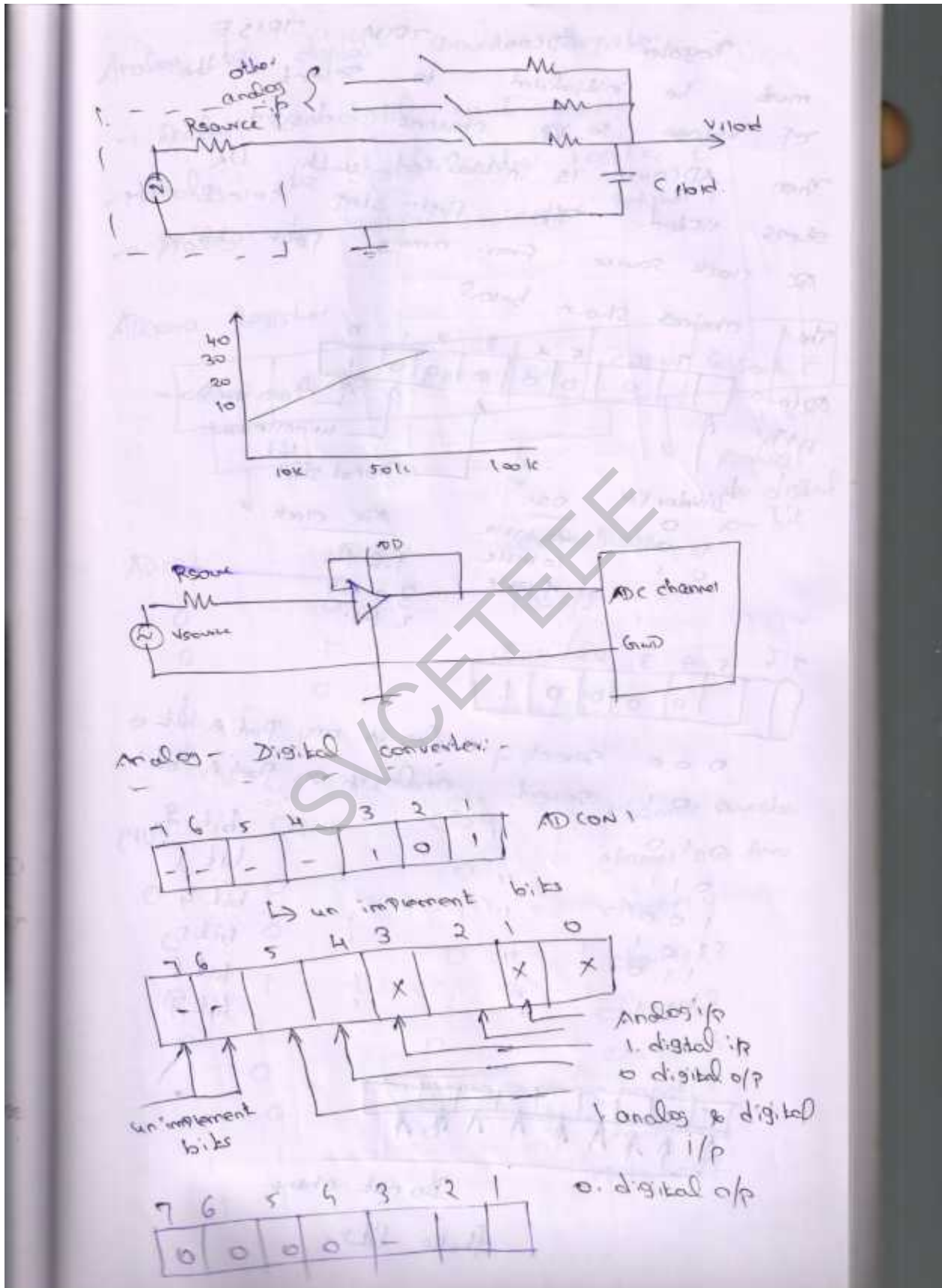
1. Voltage Ref

Internal :- $V_{REF} = V_{DD}$

External :- $3.0V \leq V_{REF} \leq V_{DD}$

2. Error from idealized

Internal V_{REF}



Register ADCON1, TRISA, TRISE must be initialized to select the ref voltage to I/P channels desired.

Then ADCON0 is initialized with the steps listed. The first step select the ADC clock source from among four choices. The choices shown below

ADCON0 bits: 7 6 5 4 3 2 1 0

ADCON0 bit 0: Turn on Power

ADCON0 bit 1: unimplemented bit

ADCON0 bit 2: Don't start

ADCON0 bits 3-7: Divider For Osc

ADCON0 bits	Divider For Osc	Osc	ADC clock
1 0	1 0	20 MHz	1.6 μs
1 0	1 0	10 MHz	3.2 μs
0 1	0 1	4 MHz	2 μs

ADCON0 bits 3-7: 7 6 5 4 3 2 1 0

0 0 0 select analog ip on Port A bit 0

0 0 1 select analog ip on Port A bit 1

0 1 0 " " bit 2

0 1 1 " " bit 3

1 0 0 " " bit 4

1 0 1 " " bit 5

1 1 0 " " bit 6

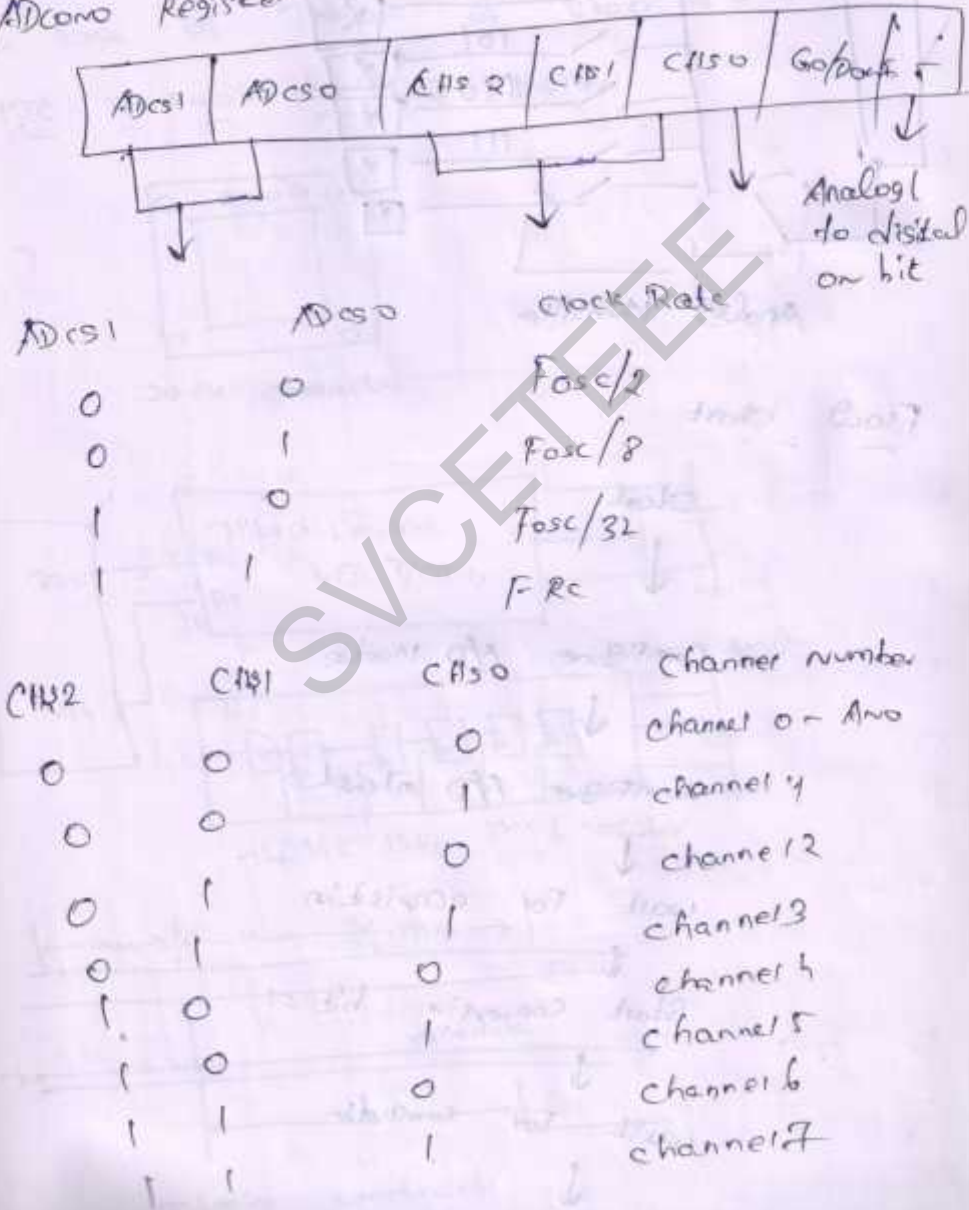
1 1 1 " " bit 7

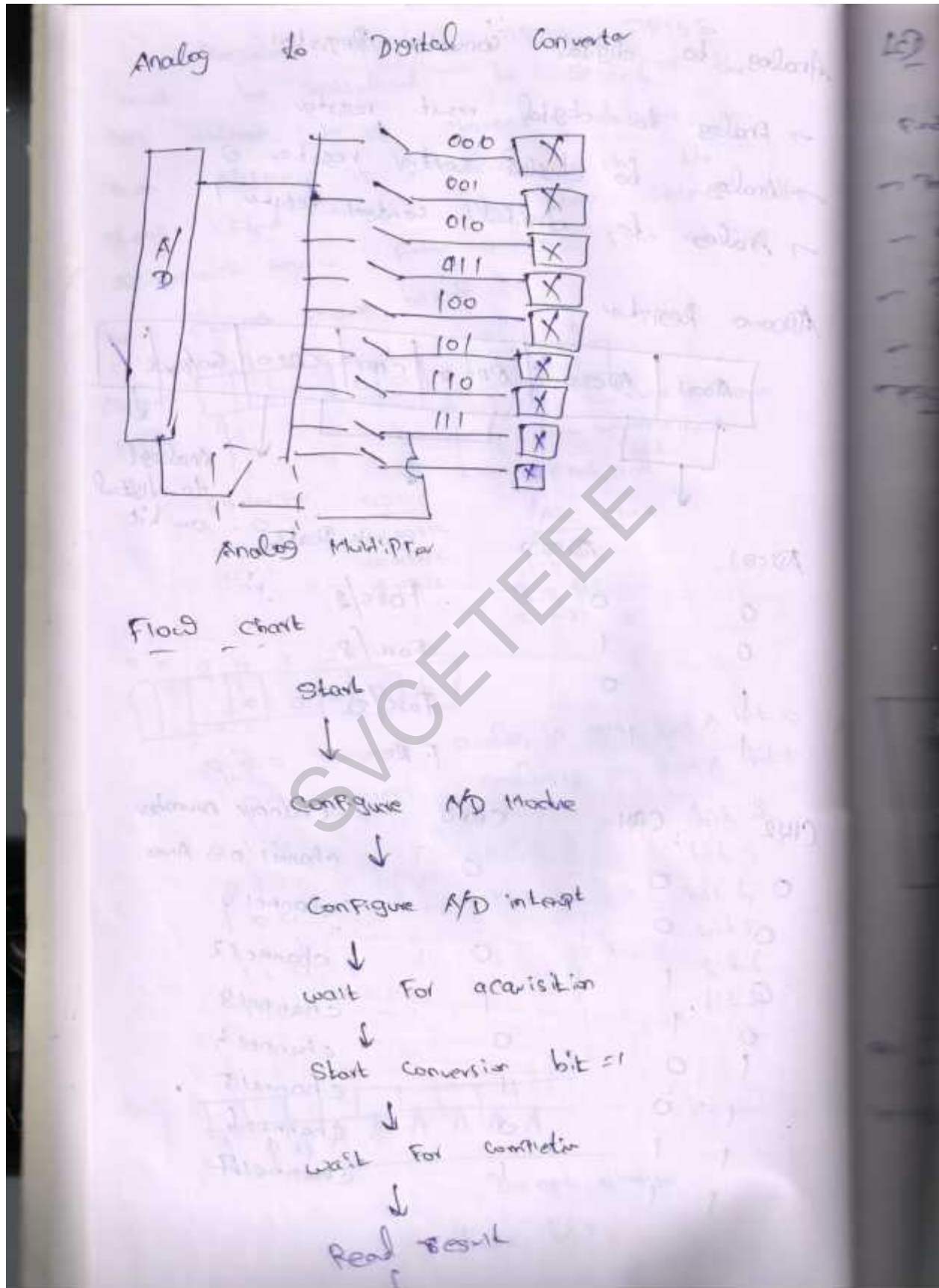
Do not change these bits

Analog to digital converter Register

- Analog to digital result register
- Analog to digital control register 0
- Analog to digital control register 1

ADCON0 Register

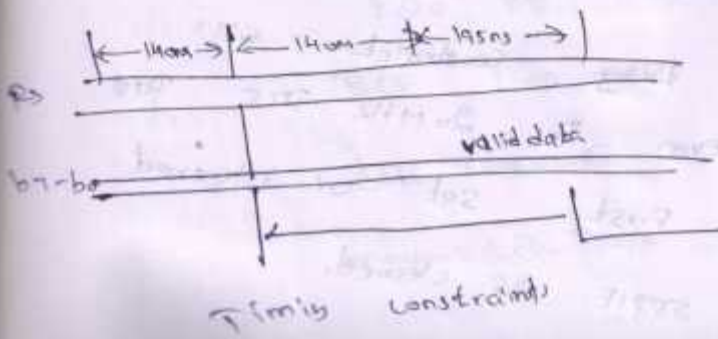
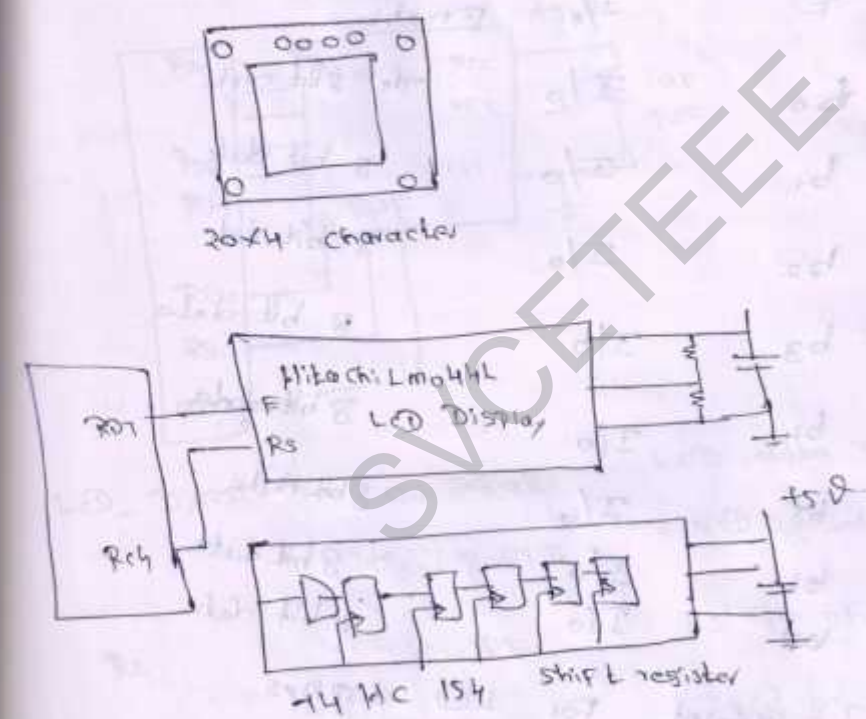




LCD Interfacing:-

- In recent years LCD has been
 find wide spread use replace LED
- The decring Price of LCD
 - Ability to display number
 - Incorporation of refreshing controller
 - Ease of Program of character & graphics

PIC interface to LCD Display:-



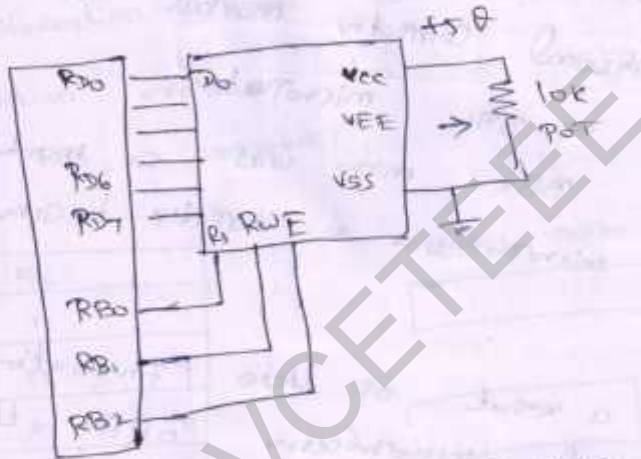
Pin	Symbol	I/O	Description
1	VSS	-	GND
2	VDD	-	+5V
3	VO	-	power supply, at
4	RS	I	RS = 0 RS = 1
5	R/O	I	R/O = 0 R/O = 1
6	E	I/O	Enable
7	b0	I/O	8 bit data
8	b1	I/O	8 bit data
9	b2	I/O	8 bit data
10	b3	I/O	8 bit data
11	b4	I/O	8 bit data
12	b5	I/O	8 bit data
13	b6	I/O	8 bit data
14	b7	I/O	8 bit data

Time Constraint For LED display:-

The timing constraint will be met even for 20 MHz PIC. RS is first set or cleared. SSPIF is cleared.

A more stringent timing constraint occur during initialization when a delay of atleast 5ms is need b/w some of control codes. time that hitachi micro controller finds necessary for carry out one action

Sending commands to data to LCD with a time delay



```

LCD_DATA EQU P0          ; LCD data Pin
LCD_CTRL EQU P3          ; LCD control Pin
RS EQU P4                ; RS Pin of LCD
RW EQU P7                ; R/W Pin of LCD
BCF LCD_CTRL, RW        ; PORT B o/p
CALL COMMWR             ; call command
MOV R0, LCD_DATA        ; copy WRFD to
                        ; display
    
```