

there is one slave so 8 data bit are sent.  
The clock is driven.

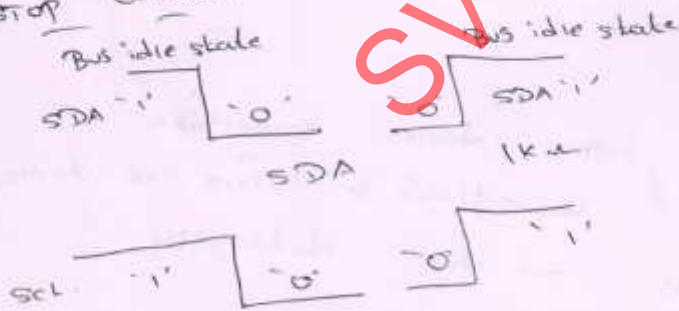
2. DISCUSS in brief about the start & stop condition:-

I<sup>2</sup>C bus transfer consist of number of byte transfer framed b/w start condition & either another start condition or stop condition.

START condition:-

when master wants to initiate data transfer it puts SDA low followed by scl being pulled low. This is called START condition.

STOP condition:-



Data Communication Protocol:-

→ I<sup>2</sup>C Communication both 7bit & 10 bit slave addressing are possible.  
7bit Address mode.

8

start  
↓  
S

7 bit address  
of slave peripheral

R/W

Internal address

Data to be written

Data to be written to address

Data to be written (N+2)

ACK

P ↓ stop condition.

Software For I<sup>2</sup>c communication.

The data transfer in I<sup>2</sup>c mode is not automatically control by hardware like UART.

bSF, status, RPO  
bCF, status, RPO

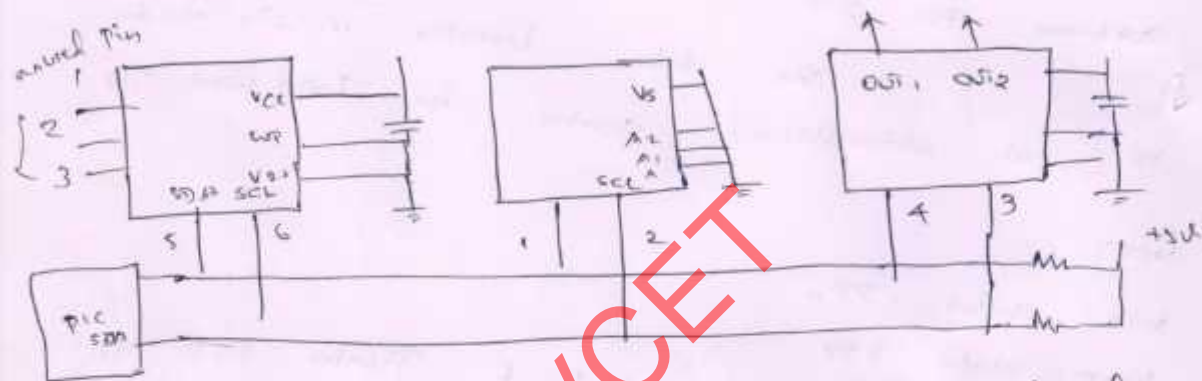
Alternatively the indirect pointer FSR can have address of TRISC and the required bit setting.

The instruction bSF NDF, SDA will release SDA line.

3) Explain in brief about the construction & operation of EEPROM:-

Technologically supplies non volatile storage device.  
PIC controlled

An EEPROM with I2C serial interface such as micro chip technology 24LC018 provide designers with a convenient solution to need non volatile storage. A block up to 8 byte can be written in 10ms. The device with its interface circuit. The wp pin permit a manufacturer



EEPROM make use of an internal address pointer that is second during second byte

4) Explain in brief about Analog to Digital Converter & enumerate its characteristics

Features:-

- \* 8 bit conversion
- \* 8 analog i/p channels
- \* Analog multiplexer

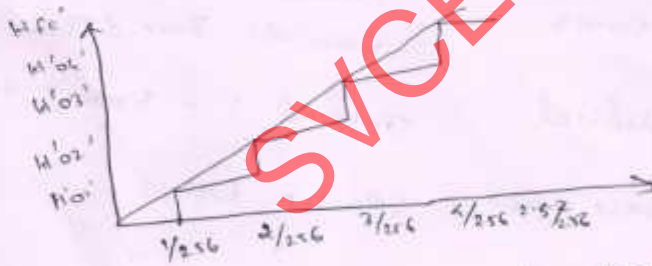
- \* Adjustable sample rate
- \* choice of an interval
- \* A track to hold circuit

ADC characteristic:-

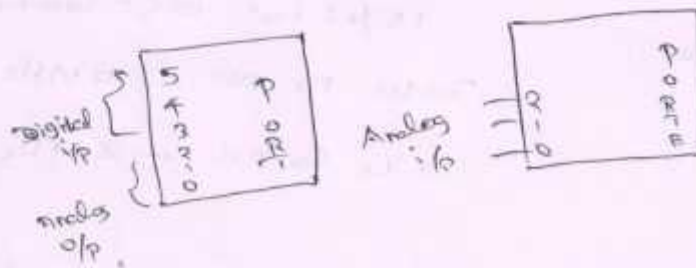
The pic Analog to digital converter has idealized transfer function. The  $V_p$  (V) is scaled against a  $V_{ref}$  produce 8 bit o/p. The  $V_{ref}$  voltage that is best suited for many application  $V_{ref}$  selected as one option to connect to ADC internally.

$$0V \leq V_{input} \leq V_{ref}$$

$$3V \leq V_{ref} \leq V_{DD}$$



5) Explain the construction & working of PORT



RA0/AN0

RA1/AN1

RA2/AN2

- Analog i/p - 0

- Analog i/p - 1

- Analog i/p - 2

RA4 / Tock1 - Clock I/p to Timer 0

RA5 / AN4 - Analog I/p 4

PORT E PINS:-

RE0 /  $\overline{RD}$  / AN5 - Analog I/p 5

RE1 /  $\overline{UR}$  / AN6 - Analog I/p 6

RE2 /  $\overline{CS}$  / AN7 - Analog I/p 7

6. Explain in brief about ADC Performance characteristics:-

- | Parameters                               | Values  |
|--|---|
| 1. Voltage Reference                     | Internal:- $V_{REF} = V_{DD}$<br>External:- $3.0V \leq V_{REF}$                             |
| 2. Error from idealized                  | Internal: - Error $\leq \pm V_{DD}/256$   |
| 3. Power supply current                  | 180 $\mu A$ , typical   |
| 4. Minimum Sample Time                   | 12 $\mu s$ for $R_{source} < 10 k\Omega$  |
| 5. Conversion Time                       | 15 $\mu s$ for $osc = 20MHz$<br>30 $\mu s$ for $osc = 10MHz$<br>19 $\mu s$ for $osc = 4MHz$ |
| 6. Interrupt when Conversion is complete | Use PEI register  |

16 Microcontroller based System Design

UNIT-III

PERIPHERAL OF PIC MICROCONTROLLER

PART-A

1. What are the different capture modes available in the capture module of PIC microcontroller? (June '12)

Ans: Three modes are there:

- CCP1
- CCP2
- CCP3.

2. Write the function of the bits EEPGD and WREXR bits in the EECON register in PIC Microcontroller. (June '12)

Ans: EEPGD-Flash Program or Data (EEPROM Memory select bit):

1 = Access Program flash memory; 0 = Access data EEPROM memory

WREXR - Write Error Flag bit:

1 = Write operation is permanently terminated; 0 = the write operation is completed.

3. Calculate the resolution of 10 bit ADC having Maximum analog value +10.0 volts. (June/July 2013)

Ans: Resolution of a converter determines the degree of accuracy in conversion. It is equal to  $1/2^{10}$ ,  $1/2^{10} = 0.000976$ .

4. What are the interrupts available in PIC? (Jan '14)

Ans:

Interrupt Source	Enabled by	Completion Status
External interrupt from INT	INTE = 1	INTF = 1
TMR0 interrupt	T0IE = 1	T0IF = 1
RB4 - RB7 state change	RBIE = 1	RBIF = 1
EEPROM write complete	EEIF = 1	-

17 Two Marks Questions and Answers

1. How EEPROM memory stores the information? (Jan '15, Jan '14)


Ans: A EEPROM is a memory that allows storing the variables, as a result of burning the written program.

2. What is flash memory? (Jan '15/Jan '13)

Ans: Erasure of the entire contents takes less than a second or one might say in a flash, hence its name flash memory. Flash memory's contents are erased (or written to), the entire device is erased.

3. Using PIC micro controller how is analog signal converted into digital. (Jan '13)

Ans: ADC to translate the analog signals to digital numbers. So, that the microcontroller can read and process them.



4. How many timers are there in PIC?

Ans: PIC may have 3 to 5 timers depending on the series of the PIC. Timer0, 1 and 2 etc...

5. Brief timer0.

Ans: It is an 8 bit wide timer. Internal clock is fixed and external clock is given at RA4 pin. It is used for timing and generating time delay.

6. How do you calculate the timer0 delay?

Ans: The delay for Timer0 is given by:

$$\text{Timer0count} \times \text{prescaler value} \times 4/f_{osc}$$

7. How do you calculate timer0 preload count?

Ans: The preload count for Timer0 is given by:

$$256 - (\text{Timer0delay} \times f_{osc}) / (\text{prescaler value} \times 4).$$

8. What are PortA pins?

Ans: The port pins of PIC are RA0, RA1, RA2, RA3 and RA4.

9. What is the function of TRISA pin?

Ans: Setting TRISA bit will configure portA as input and resetting will configure as output port.

18	Microcontroller Based System Design	Two Marks Questions and Answers	18
14. Write a program to initialize port A.	<pre> Ans: Org9 bcSTATUS.BP0 clrfPORTA bcSTATUS.BP0 movlw00010000H movwCTRISA End </pre>	<ul style="list-style-type: none"> <li>• Send 3BH to the 8 bit data line for initialization</li> <li>• Send 0FH for making LCD ON, cursor ON and cursor blinking ON.</li> <li>• Send 06H for incrementing cursor position.</li> <li>• Send 01H for clearing the display and return the cursor.</li> </ul>	
15. What is the status of ADON?	<p>Ans: When ADON = 0 then AD is off, when ADON = 1 then AD is turned ON.</p>	<p><b>Sending data to the LCD.</b></p>	
16. What are the bit positions of ADCON?	<p>Ans: D0-ADON, D1-ADDF, D2-Go/Done, D3-CHSO, D4-CHSI, D5-undefined, D6-ADSC0, D7-ADSC1.</p>	<p>The steps for sending data to the LCD module are given below. It is the logic state of these pins that make the module to determine whether a given data input is a command or data to be displayed.</p>	
17. Explain about UART?	<p>Ans: Universal asynchronous receiver transmitter. UART is useful for receiving and transmission of data in asynchronous mode.</p>	<ul style="list-style-type: none"> <li>• Make R/W low.</li> <li>• Make RS = 0 if data byte is a command and make RS = 1 if the data byte is a data to be displayed.</li> <li>• Place data byte on the data register.</li> <li>• Pulse E from high to low.</li> <li>• Repeat above steps for sending another data.</li> </ul>	
18. What is synchronous and asynchronous transmission.	<p>Ans: Asynchronous - start and stop bit allowed for transmission of data. Synchronous - no start and stop bit only block transfer data.</p>	<p>22. What is a data acquisition system? <span style="float: right;">(June '12) (Jan '14)</span></p>	
19. What is baud rate in asynchronous mode?	<p>Ans: The baud rate in asynchronous mode is given by <math>B.R = F_{clk}/64(x+1)</math> for low speed, and <math>F_{clk}/16(x+1)</math> for high speed.</p>	<p>Ans: Data acquisition is the process of sampling signals that measure real world physical conditions and converting the resulting samples into digital numeric values that can be manipulated by a computer. Data acquisition systems typically convert analog waveforms into digital values.</p>	
20. How do you configure the ports as input and output?	<p>Ans: Any ports can be made as input by setting the port pin and they can be set as output by resetting the port bit.</p>	<p>23. What are the types of data acquisition system?</p>	
21. How can the LCD be tested whether it is ready or not to receive a command or data? <span style="float: right;">(June '12)</span>	<p>Ans: The steps that has to be done for initializing the LCD display is given below and these steps are common for almost all applications.</p>	<p>Ans: There are two types of data acquisition system:</p>	
		<ul style="list-style-type: none"> <li>(i) single and</li> <li>(ii) multichannel data acquisition system.</li> </ul>	
		<p>24. What are the advantages of microcontroller based control over conventional control? <span style="float: right;">(Jan/July 2013).</span></p>	
		<p>Ans:</p> <ul style="list-style-type: none"> <li>• Speed is high.</li> <li>• Hardware requirement is very less.</li> </ul>	

20

Microcontroller based System Design

25. State the principle of measurement of frequency using 8051 (Just the block diagram). (June/July 2012)

Ans:

Fig.: Frequency Generator Schematic

26. What is interfacing? (Jun '14)

Ans: Interfacing means connecting microcontroller with external devices. The external devices are input devices, output devices, Memory chip, External applications.

27. While programming for LCD display, what initialization has to be done? (Jun '13)

Ans: When D7=0, the LCD is ready to receive new information.

28. What is the need for D/A converter? (April/May 2011)

Ans: D/A converter (Digital to Analog Converter) is used to interface the microprocessor output with the external device.

29. Program to rotate the stepper motor clockwise/anticlockwise continuously with full

21

Two Marks Questions and Answers

Ans:

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MOV A, #00H
BACK: MOV P1, A
RRA
ACALL DELAY
SJMP BACK
DELAY: MOV R1, #100
UP1: MOV R2, #50
UP: DJNZ R2, UP
      DJNZ R1, UP1
      RET
    
```

30. In key board interface, if RB7 - RB4 = 0111 is the data read from the columns, which column does the pressed key belong to?

Ans: If RB7 - RB4 = 0111 is the data read from the columns, then column number 3 is activated.

31. Why do we put a driver between the microcontroller and the DC motor?

Ans: A driver is needed between the microcontroller and the DC motor because the microcontroller digital outputs lack sufficient current to drive the DC motor. It needs an external driver to drive the motor.

32. How to calculate the duty ratio in PWM.

Ans: Duty ratio in PWM is given by  $D = \frac{TON}{T}$ .

33. What is the DC value of the PWM output?

Ans: Ranges from zero to whatever maximum value is used to power the motor.

34. What is voltage regulation of DC-DC converter?

Ans: This is to stabilize the output signal in a converter using DSP processor as a controller.

35. Define delay angle or firing angle.

Ans: Delay angle or firing angle is defined as the time after the input voltage starts to go positive until the thyristor is triggered  $\alpha$ .

36. How to change the output voltage of a square wave inverter?

Ans: By using the PWM (Pulse Width Modulation) techniques, the output voltage of an inverter can be varied.



22 Microcontroller based Systems

37. Give the 4 step sequence of a stepper motor if we start with 010.

Ans: 0110, 0011, 1001, 1100 for clockwise and 0110, 1100, 1001, 0011 for counter-clockwise.

38. In what ways CISC and RISC processors differ?

CISC	RISC
It provides number of addressing modes.	It provides very few addressing modes.
It has a micro programmed unit with a control memory.	It has a hardwired unit without a control memory.
An easy compiler design.	Complex compiler design.
Provide precise and intensive calculations slower than a RISC.	Provide precise and intensive calculations faster than a CISC.

39. Draw the circuit diagram of motor interfacing.

Ans:

Fig.

40. What is the angle through which a stepper motor will rotate for every output Step pulse from the microcontroller?

Ans: The angle through which the stepper motor will rotate is known as the step angle. It depends on the number of poles of the stepper motor.

(PART-B) SIXTEEN MARKS

1. Explain the interrupt structure of PIC 16F877 indicating all the registers associated with the interrupts. (Jan '12)
2. Discuss the floppy disk and its applications. Also explain how to interface it with PIC. (Jan '13)
3. Explain in detail how analog interfacing with PIC can be accomplished using the digital I/O functions of PIC. (Jan '13)
4. Discuss briefly how serial interfacing is accomplished in PIC. (Jan '15)
5. With an application program explain in detail the compare, capture mode of the PIC microcontroller with a neat circuit diagram. (Jan '13)
6. Discuss in detail about the following:
  - (i) Timers and (ii) Interrupt (Jan '13)
7. (i) Discuss in detail of FC in PIC microcontroller. (Jan '13)
- (ii) Briefly explain about UART in PIC microcontroller. (Jan '13)
8. How asynchronous communication is carried out in PIC 16F77A? Explain in detail.
9. Explain the I/O ports in PIC microcontroller.
10. Briefly explain about flash memory in PIC with necessary diagram.
11. Interface a 4x4 hexadecimal keyboard with 8051 and write ALP program to find the key number that is pressed in the keyboard and send the ASCII code of that key number to parallel port2 of 8051. (June '12) (June/July 2013) (Jan '13)
12. With necessary diagram, explain the case study of generation of gating signals for a single phase half controller rectifier used to control speed of a DC motor using any one microcontroller. (Jan '12)
13. Draw the circuitry to interface motor with a microcontroller for controlling its speed and write the program. (Jan '13)
14. Write a program for a microcontroller case study to generate control signals for a converter circuit. (Jan '13)
15. Explain the case study for controlling of AC and DC application using microcontroller. (Jan '2014)

SVCET