

# Microprocessor and its Applications (EC331)

## ASSIGNMENT -1

### 1. *What is Microprocessor? What are the basic units of a microprocessor?*

It is a program controlled semiconductor device (IC), which fetches, decode and executes instructions.

The basic units or blocks of a microprocessor are ALU, an array of registers and control unit .

### 2. *Explain the function of IO/M, READY, HOLD and HLDA in 8085.*

The IO/M is used to differentiate memory access and I/O access. For IN and OUT instruction it is high. For memory reference instructions it is low.

READY is an input signal to the processor, used by the memory or I/O devices to get extra time for data transfer or to introduce wait states in the bus cycles.

HOLD and HLDA signals are used for the Direct Memory Access (DMA) type of data transfer. The DMA controller place a high on HOLD pin in order to take control of the system bus. The HOLD request is acknowledged by the 8085 by driving all its tristated pins to high impedance state and asserting HLDA signal high.

### 3. *What is a flag? List the flags of 8085.*

Flag is a flip flop used to store the information about the status of the processor and the status of the instruction executed most recently.

There are five flags in 8085. They are sign flag, zero flag, Auxiliary carry flag, parity flag and carry flag.

### 4. *Define mnemonics.*

The short-hand form of describing the instructions are called mnemonics. The mnemonics are given by the manufacturers of microprocessors and programmable devices.

5. *What is processor cycle (Machine cycle) ,Instruction cycle, fetch and execute cycle?*

The processor cycle or machine cycle is the basic operation performed by the processor. To execute an instruction, the processor will run one or more machine cycles in a particular order.

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The sequence of operations that a processor has to carry out while executing the instruction is called Instruction cycle. Each instruction cycle of a processor in turn consists of a number of machine cycles.

In general, the instruction cycle of an instruction can be divided into fetch and execute cycles. The fetch cycle is executed to fetch the opcode from memory. The execute cycle is executed to decode the instruction and to perform the work instructed by the instruction.

6. *List the various machine cycles of 8085*

The various machine cycles of 8085 are

- (i) Opcode fetch cycle
- (ii) Memory read cycle
- (iii) Memory write cycle
- (iv) I/O read cycle
- (v) I/O write cycle
- (vi) Interrupt acknowledge cycle
- (vii) Bus idle cycle.

7. *What is the need for timing diagram?*

The timing diagram provides information regarding the status of various signals, when a machine cycle is executed. The knowledge of timing diagram is essential for system designer to select matched peripheral devices like memories, latches, ports, etc., to form a microprocessor system.

8. *What is T-state?*

The T-state is the time period of the internal clock signal of the processor. The time taken by the processor to execute the machine cycle is expressed in T-state.

*9. Define opcode and operand.*

Opcode (Operation code) is the part of an instruction / directive that identifies a specific operation.

Operand is a part of an instruction / directive that represents a value on which the instruction acts.

*10. What is addressing? What are the various addressing modes available in 8085?*

The method of specifying the data to be operated by the instruction is called addressing.

The 8085 has the following five different types of addressing.

1. Immediate addressing
2. Direct addressing
3. Register addressing
4. Register indirect addressing
5. Implied addressing

*11. Compare the memory mapped I/O and standard I/O mapped I/O.*

Memory Mapped I/O	Standard I/O mapped I/O
1. 16-bit address is allotted to an I/O device	1. 8-bit address is allotted to an I/O device.
2. The devices are accessed by I/O read or I/O write cycle.	2. The devices are accessed by memory read or memory write cycle.
3. All instructions related to memory can be used for data transfer.	3. Only IN and OUT instructions can be used for data transfer.
4. A large number of I/O ports can be interfaced.	4. Only 256 ports can be interfaced.

*12. What is meant by memory mapping? What is memory access time?*

The memory mapping is the process of interfacing memories to microprocessor and allocating addresses to each memory locations. The memory access time is the time taken by the processor to read or write a memory location. During read operation it is the time between a valid address on the bus and end of read control signal. During write operation it is the time between a valid address on the bus and the end of write control signal.

### *13. What is an Interrupt? How the interrupt are classified?*

Interrupt is a signal send by an external device to the processor so as to request the processor to perform a particular task or work.

They are three methods of classifying interrupts

Method I :The interrupts are classified into Hardware and Software interrupts

Method II:The interrupts are classified into vectored and Non-Vectored interrupt

### *14. What is Vectored and Non- Vectored interrupt?*

When an interrupt is accepted, if the processor control branches to a specific address defined by the manufacturer then the interrupt is called vectored interrupt.

In Non-vectored interrupt there is no specific address for storing the interrupt service routine. Hence the interrupted device should give the address of the interrupt service routine.

### *15. What is Polling? What are the different types of Polling?*

Polling is a scheme or an algorithm to identify the devices interrupting the processor. Polling is employed when multiple devices interrupt the processor through one interrupt pin of the processor.

The polling can be classified into software and hardware polling. In software polling the entire polling process is govern by a program. In hardware polling, the hardware takes care of checking the status of interrupting devices and allowing one by one to the processor.

*16. What is mean by microcontroller?*

A device which contains the microprocessor with integrated peripherals like memory, serial ports, parallel ports, timer/counter, interrupt controller, data acquisition interfaces like ADC, DAC is called microcontroller.

**ASSIGNMENT -2**

*17. Explain DJNZ instructions of intel 8051 microcontroller?*

- a. DJNZ Rn, rel  
Decrement the content of the register Rn and jump if not zero.
- b. DJNZ direct, rel  
Decrement the content of direct 8-bit address and jump if not zero.

*18. Specify the single instruction, which clears the most significant bit of B register of 8051, without affecting the remaining bits.*

Single instruction, which clears the most significant bit of B register of 8051, without affecting the remaining bits is CLR B.7.

*19. Explain the function of the pins PSEN and EA of 8051.*

PSEN :

PSEN stands for program store enable. In 8051 based system in which an external ROM holds the program code, this pin is connected to the OE pin of the ROM.

EA :

EA stands for external access. When the EA pin is connected to Vcc, program fetched to addresses 0000H through 0FFFH are directed to the internal ROM and program fetches to addresses 1000H through FFFFH are directed to external ROM/EPROM. When the EA pin is grounded, all



addresses fetched by program are directed to the external ROM/EPROM.

*20. Explain the 16-bit registers DPTR and SP of 8051.*

DPTR:

DPTR stands for data pointer. DPTR consists of a high byte (DPH) and a low byte (DPL). Its function is to hold a 16-bit address. It may be manipulated as a 16-bit data register or as two independent 8-bit registers. It serves as a base register in indirect jumps, lookup table instructions and external data transfer.

SP:

SP stands for stack pointer. SP is a 8-bit wide register. It is incremented before data is stored during PUSH and CALL instructions. The stack array can reside anywhere in on-chip RAM. The stack pointer is initialized to 07H after a reset. This causes the stack to begin at location 08H.

*21. Name the special functions registers available in 8051.*

- c. Accumulator
- d. B Register
- e. Program Status Word.
- f. Stack Pointer.
- g. Data Pointer.
- h. Port 0
- i. Port 1
- j. Port 2
- k. Port 3
- l. Interrupt priority control register.
- m. Interrupt enable control register.

*22. Write down the different operating modes for serial communication of 8051.*

Serial communication of 8051 operate under four modes. They are mode 0, mode 1, mode 2 and mode 3. SM0 and SM1 bits of SCON register specifies the mode.

SM0	SM1	Mode
0	0	0 Baud rate fixed.
0	1	1 8-bit data, 1 stop bit, 1 start bit. Baud rate variable.
1	0	2 8-bit data, 9 <sup>th</sup> programmable bit, 1 stop bit, 1

start bit, Baud rate fixed.  
 1 1 3 8-bit data, 9<sup>th</sup> programmable bit, 1 stop bit, 1  
 start bit, Baud rate variable.

*23.Explain the register IE format of 8051.*

EA	-	ET2	ES	ET1	EX1	ET0	EX0
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EA- Enable all control bit.  
 ET2- Timer 2 interrupt enable bit.  
 ES – Enable serial port control bit.  
 ET1 – Enable Timer1 control bit.  
 EX1- Enable external interrupt1 control bit.  
 ET0 – Enable Timer0 control bit.  
 EX0- Enable external interrupt0 control bit.

*24. Compare Microprocessor and Microcontroller.*

Sl.No	Microprocessor	Microcontroller
1	Microprocessor contains ALU,general purpose registers,stack pointer, program counter, clock timing circuit and interrupt circuit.	Microcontroller contains the circuitry of microprocessor and in addition it has built- in ROM, RAM, I/O devices, timers and counters.
2	It has many instructions to move data between memory and CPU.	It has one or two instructions to move data between memory and CPU.
3	It has one or two bit handling instructions.	It has many bit handling instructions.
4	Access times for memory and I/ O devices are more.	Less access times for built-in memory and I/O devices.
5	Microprocessor based system requires more hardware.	Microcontroller based system requires less hardware reducing PCB size and increasing the reliability.

*25. How the RS -232C serial bus is interfaced to 1TL logic device?*

The RS-232C signal voltage levels are not compatible with TTL logic levels. Hence for interfacing TTL devices to RS-232C serial bus, level converters are used. The popularly used level converters are MC 1488

& MC 1489 or MAX 232.

*26. List some of the features of 8096 microcontroller.*

- a. The 8096 is a 16-bit microcontroller.
- b. The 8096 is designed to use in applications which require high speed calculations and fast I/O operations.
- c. The high speed I/O section of an 8096 includes a 16 bit timer, a 16 bit counter, a 4 input programmable edge detector, 4 software timers and a 6-output programmable event generator.
- d. It has 100 instructions, which can operate on bit, byte, word, double words.
- e. The bit operations are possible and these can be performed on any bit in the register file or in the special function register.

*27. What is HS0 of 8096?*

HS0:

The High Speed Output unit (HS0) is used to trigger events at specific times with minimal CPU overhead. These events include : starting an A to D conversion, resetting Timer2, setting 4 software flags, and switching up to 6 output lines.

*28. List the features of 8051 microcontroller?*

The features are

- \*single\_supply +5 volt operation using HMOS technology.
- \*4096 bytes program memory on chip(not on 8031)
- \*128 data memory on chip.
- \*Four register banks.
- \*Two multiple mode,16-bit timer/counter.
- \*Extensive boolean processing capabilities.
  - \*64 KB external RAM size
  - \*32 bidirectional individually addressable I/O lines.
  - \*8 bit CPU optimized for control applications.

*29. What are the modes in which 8086 can operate?*

The 8086 can operate in two modes and they are minimum ( or uniprocessor) mode and maximum ( or multiprocessor) mode.

*30. What are the interrupts of 8086?*

The interrupts of 8085 are INTR and NMI. The INTR is general



maskable interrupt and NMI is non-maskable interrupt.

*31. How clock signal is generated in 8086? What is the maximum internal clock frequency of 8086?*

The 8086 does not have on-chip clock generation circuit. Hence the clock generator chip, 8284 is connected to the CLK pin of 8086. The clock signal supplied by 8284 is divided by three for internal use. The maximum internal clock frequency of 8086 is 5MHz.

*32. What is pipelined architecture?*

In pipelined architecture the processor will have number of functional units and the execution time of functional units are overlapped. Each functional unit works independently most of the time.

### **ASSIGNMENT -3**

*33. What are the functional units available in 8086 architecture?*

The bus interface unit and execution unit are the two functional units available in 8086 architecture.

*34. List the segment registers of 8086.*

The segment registers of 8086 are Code segment, Data segment, Stack segment and Extra segment registers.

*35. What is the difference between segment register and general purpose register?*

The segment registers are used to store 16 bit segment base address of the four memory segments. The general purpose registers are used as the source or destination register during data transfer and computation, as pointers to memory and as counters.

*36. What is queue? How queue is implemented in 8086?*

A data structure which can be accessed on the basis of first in first

out is called queue. The 8086 has six numbers of 8-bit FIFO registers, which is used for instruction queue.

*37. Write the special functions carried by the general purpose registers of 8086.*

The special functions carried by the registers of 8086 are the following.

Register Special function

AX 16-bit Accumulator

AL 8-bit Accumulator

BX Base Register

CX Count Register

DX Data Register

*38. Write the flags of 8086.*

The 8086 has nine flags and they are

1. Carry Flag (CF)    6. Overflow Flag (OF)
2. Parity Flag (PF)    7. Trace Flag (TF)
3. Auxiliary carry Flag (AF)    8. Interrupt Flag (IF)
4. Zero Flag (ZF)    9. Direction Flag (DF)
5. Sign Flag (SF)

*39. What are control bits?*

The flags TF, IF and DF of 8086 are used to control the processor operation and so they are called control bits.

*40. Describe the difference between the instructions MOV AX,2437H and MOV AX,[2437H].*

Difference between the instructions MOV AX,2437H and MOV AX,[2437H] are former instruction takes 2437 as 16-bit data and latter instruction takes 2437 as 16-bit address.

*41. State the function of Direction flag in 8086.*

Direction flag is used with string instructions. If DF= 0, the string is processed from its beginning with the first element having the lowest address. Otherwise, the string is processed from the high address towards the low address.

*42. Mention the three operating modes of Intel 80386 processor.*

- i. Real Mode.
- ii. Protected Mode.

iii. Virtual 8086 Mode.

*43. What happens in 8086 processor, when*

- b. overflow of sum occurs during addition of signed numbers.*
- c. overflow of quotient occurs during division operation.*

- a. When overflow of sum occurs during addition of signed numbers, overflow flag is set to one (OVF =1).
- b. When overflow of quotient occurs during division operation, type 0 (divide by zero ) interrupt is generated.

*44. Discuss the functions of the following prefixes:*

**LOCK, ESCAPE**

**LOCK :**

In a multiprocessor system each microprocessor has its own local buses and memory. The individual microprocessors are connected together by a system bus so that each can access system resources such as disk drives or memory. Each microprocessor only takes control of the system bus when it needs to access some system resources. The LOCK prefix allows a microprocessor to make sure that another processor does not take control of the system bus while it is in the middle of a critical instruction which uses the system bus.

**ESCAPE:**

This instruction is used to pass instructions to a coprocessor such as the 8087 math coprocessor which shares the address and data bus with an 8086.

*45 . What are the flag manipulation instructions of 8086.*

- i) LAHF : Load AH from low byte of flag register.
- ii) SAHF : Store AH to low byte of flag register
- iii) PUSHF : Push content of flag to the stack.
- iv) POPF : Pop content of stack and load it in the flag register.

*46. What is the need for interrupt controller?*

The interrupt controller is employed to expand the interrupt inputs. It can handle the interrupt request from various devices and allow one by one to the processor.

*47. List some of the features of INTEL 8259 (Programmable Interrupt Controller )*

- i) It manage eight interrupt request.
- ii) The interrupt vector addresses are programmable.
- iii) The priorities of interrupts are programmable.
- iv) The interrupt can be masked or unmasked individually.

*48. Write the various functional blocks of INTEL 8259 ?*

The various functional blocks of 8259 are

Control logic, Read/ Write logic, Data bus buffer, IRR, ISR, IMR, Priority resolver and cascade buffer

IRR - Interrupt Request Register

ISR - In-Service Register

IMR Interrupt Mask Register,

**ASSIGNMENT -4**

*49.What is Master and Slave 8259 ?*

When 8259's are connected in cascade, one 8259 will be directly interrupting 8085 and it is called master 8259, To each interrupt request input of master 8259, one slave 8259 can be connected, The 8259 's interrupting the master 8259 are called slave 8259.

*50. How 8259 is programmed?*

The 8259 is programmed by sending

- i) Initialization Command Words (ICWs) and
- ii)Operational Command Words (OCWs).

*51. What is a programmable peripheral device ?*

If the functions performed by a peripheral device can be altered or changed by a program instruction then the peripheral device is called programmable device. Usually the programmable devices will have control registers. The device can be programmed by sending control word in the prescribed format to the control register.

*52. What is handshake port? Explain the working of a handshake input port and output port.*

In handshake port, signals are exchanged between I/O device and port or port and processor for checking or informing various condition of the device.

In handshake input operation, the input device will check whether the port is empty or not. If the port is empty then it will load data to port. When the port receives the data, it will inform the processor for read operation. Once the data have been read by the processor, the port will signal the input device that it is empty. Now the input device can load another data to port and the above process is repeated.

In handshake output operation, the processor will load a data to port. When the port receives the data, it will inform the output device to collect the data. Once the output device accepts the data, the port will inform the processor that it is empty. Now the processor can load another data to port and the above process is repeated.

*53. What are the internal devices of 8255?*

The internal devices of 8255 are port-A, port-B and port-C. The ports can be programmed for either input or output function in different operating modes.

*54. What are the operating modes of port -A 8255?*

The port-A of 8255 can be programmed to work in anyone of the following operating modes as input or output port.

Mode-0 : Simple 1/0 port.

Mode-1: Handshake 1/0 port

Mode-2 : Bidirectional 1/0 port

*55. What are the functions performed by port-C of 8255?*



1. The port-C pins are used for handshake signals.
2. Port-C can be used as an 8-bit parallel I/O port in mode-0.
3. It can be used as two numbers of 4-bit parallel port in mode-0.
4. The individual pins of port-C can be set or reset for various control applications.

*56. What are the different scan modes of 8279?*

The different scan modes of 8279 are decoded scan and encoded scan. In decoded scan mode, the output of scan lines will be similar to a 2-to-4 decoder. In encoded scan mode, the output of scan lines will be binary count, and so an external decoder should be used to convert the binary count to decoded output.

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*57. What is baud rate?*

The baud rate is the rate at which the serial data are transmitted. Baud rate is defined as  $1/(\text{The time for a bit cell})$ . In some systems one bit cell has one data bit, then the baud rate and bits/sec are same.

*58 . What is USART? What are the functions performed by INTEL 8251A?*

The device which can be programmed to perform Synchronous or Asynchronous serial communication is called USART (Universal Synchronous Asynchronous Receiver Transmitter). The INTEL 8251A is an example of USART.

The INTEL 8251A is used for converting parallel data to serial or vice versa. The data transmission or reception can be either asynchronously or synchronously. The 8251A can be used to interface MODEM and establish serial communication through MODEM over telephone lines.

*59 . What are the control words of 8251A and what are its functions?*

The control words of 8251A are Mode word and Command word. The mode word informs 8251 about the baud rate, character length,

parity and stop bits. The command word can be send to enable the data transmission and reception.

*60. What is debouncing ?*

When a key is, pressed it bounces for a short time. If a key code is generated immediately after sensing a key actuation, then the processor will generate the same keycode a number of times.(A key typically bounces for 10 to 20 msec). Hence the processor has to wait for the key bounces to settle before reading the keycode. This process is called keyboard debouncing.

*61. What is the difference in programming the 8279 for encoded scan and decoded scan?*

If the 8279 is programmed for decoded scan then the output of scan lines will be decoded output and if it is programmed for, encoded scan then the output of scan lines will be binary count. In encoded mode, an external decoder should be used to decode the scan lines.

*62. What are the different types of ADC?*

The different types of ADC are successive approximation ADC, counter type ADC flash type ADC, integrator converters and voltage-to-frequency converters.

*63. What is DMA Controller?*

Direct Memory Access is an I/O technique used for high speed data transfer. In DMA, the MPU releases the control of the buses to a device called a DMA controller. The controller manages data transfer between memory and a peripheral under its control, thus bypassing the MPU.

*64. Explain the function of the signal ADSTB in DMA controller?*

The 8257 has eight address lines, but requires 16 address lines to address a memory location. The additional eight lines are generated by using the signal ADSTB to strobe a high-order memory address into the 8212 from the data bus.

**ASSIGNMENT -5**

*65. Explain the function of inservice register, masking register and interrupt request register of 8259?*

Inservice Register:

ISR stores all the levels that are currently being serviced.

Masking Register:

IMR stores the masking bits of the interrupt lines  
to be masked.

Interrupt Request Register:

IRR stores the interrupt request, when interrupt request  
lines goes high.

#### *66. What is a Simulator?*

Simulator is a debugging tool used for microcomputer based system. The simulator program shows all internal registers, entire memory and peripheral on the monitor. The simulator is supported with single step and breakpoint facilities which help user to debug their programs.

#### *67. Why it is necessary to include diode across the inductive loads while controlling them through the port lines.*

Since inductor opposes changes in current. When the transistor is switched off, the current in the inductor does not reach to zero immediately, it flows for a while. However, this current cannot flow through transistor because it is off. Instead, this current develops a voltage across inductor with reverse polarities, i.e. -ve at the top and +ve at the bottom of the given circuit. This reverse voltage is large enough to break down the transistor. The free wheeling diode provides the path for induced current and clamps the reverse voltage across inductor at 0.7 V.

#### *68. Why Gray code is used in shaft angle encoder.*

Usually gray code is used rather than a normal binary code because

- i) Gray code reduces the size of the largest possible error in reading the shaft position to the value of the least significant bit.
- ii) Gray code disk has the advantage that each position is represented by a specific code which can be directly read through the input port by the microcomputer.

#### *69. What is Optical motor shaft encoders? What are the basic types of motor shaft encoders?*

Optical motor shaft encoders are used

- i) to get the information about the position, direction of rotation, and speed of rotation of various motor shafts.
- ii) They provide the above information in digital form which can

easily be used by microcomputers to control the speed, direction of rotation and position of the motor shaft.

Two basic types of motor shaft encoders are:

- i) Absolute Encoders.
- ii) Incremental Encoders.

*70. What are the various elements of process control system?*

Elements of process control systems are:

- iii) Signal Converter.
- iv) Actuator.
- v) Final control element.
- vi) Process.

*71. Define transducer and sensor?*

Non electrical quantity such as light, pressure, temperature etc is converted into a proportional electrical signal by a device called transducer.

Electrical transducer consists of two parts which are closely related to each other. These two parts are sensing or detecting element and transduction element. The sensing or detecting element is commonly known as sensor.

*72. Explain LVDT?*

LVDT stands for linear variable differential transformer. LVDT belongs to the type of transducer which is used to measure force, pressure or position. It

consists of single primary winding  $P_1$  and two secondary windings  $S_1$  and  $S_2$ .

*73. Explain microprocessor based scale? What are the basic elements of microprocessor based scale?*

Microprocessor based scale is used to read the physical parameter and Display it on the digital display.

Basic elements of microprocessor based scale are:

- i) Load cell.
- ii) Signal conditioner and amplifier.
- iii) A/D Converter
- iv) Keyboard.

- v) Display.
- vi) Microprocessor.

*74. Name some of the prototype microcomputer based instrument.*

Prototype microcomputer based instruments are:

- vii) Logic Analyzer.
- viii) In-circuit Emulator.
- ix) Simulator.

*75. What is robot? List some of the advantages of robotics?*

An important tool for a increasing productivity through electronic control of a automation system is a robot.

Advantages:

- i) Due to computerized and accurate control, it gives high and uniform production quality.
- ii) It can work without any break resulting increased productivity.
- iii) It can work in unpleasant or hazardous environment.
- iv) Most of the robots are easily trained and retrained to perform tasks. This saves training of human being which usually cost more.

*76. Explain embedded controllers?*

Many automatic control systems such as washing machine, microwave oven, programmable sewing machine, remote control stereo system etc. are built-up with separately designed microprocessors. These specially designed microprocessors are called embedded controllers.

*77. Define digital signal processing? What are the basic elements of DSP?*

Digital signal processing is used to describe any system which accepts

Samples of a signal with an A/D converter, processes the samples with a Microcomputer, and sends the computed result to a D/A converter of some other Device.

Basic elements of DSP are:

- i) A/D converter.
- ii) Digital signal processor.
- iii) D/A converter.
- iv)



*78. List some of the advantages of digital signal processing?*

- x) Digital signal processing systems are flexible. The system can be reconfigured for some other operations by simply changing the software program.
- xi) Accuracy of DSP systems is much higher than analog systems. Because analog systems suffer from component tolerances, and electrical noise.
- xii) The digital signals can be easily stored on the storage media. They are also easily transportable compared to analog signals. Therefore, the remote processing of digital signals is possible.
- xiii) Mathematical operation can be accurately performed on digital signals compared to analog signals.
- xiv) The performance of digital processing is exactly repeatable. In analog processing it may deteriorate due to noise effects and aging of components.
- xv) DSP systems are small in size, more reliable and less expensive compared to analog processing systems.

*79. List the features of DSP Processors?*

- xvi) They provide sizable amount of on-chip register, ROM and RAM so data and instructions can be accessed very quickly.
- xvii) They follow the Harvard architecture which provides separate buses for data and instruction. These parallel buses allow instructions and data to be fetched at the same time.
- xviii) The internal architecture of these processor is optimized to perform 16X16 or 32X32 bit multiplication in one clock cycle.
- xix) They provide 32-bit barrel shifter which allows shifting of 32-bit data in one clock cycle.
- xx) The instruction set of DSP processor is optimized for DSP applications.

*80 What is digital filter? What are the two basic algorithms used for digital filtering?*

The basic principle of a digital filter is to take continuous samples of the input waveform, perform the frequency related operations such as low pass, high pass, band pass and band reject, and output the processed results to the D/A converter. The processing is done by microcomputer and specially designed software.

Two basic algorithms used are:

- i) Finite impulse response (FIR).
- ii) Infinite impulse response (IIR).

81. Write the output equation for FIR and IIR?

FIR:

(Current sample  $\times$  some coefficient) + (Previous sample  $\times$  some coefficient) + (sample before previous sample  $\times$  some coefficient).

IIR:

(Current sample  $\times$  calculated coefficient) + (Previous output value  $\times$  calculated coefficient) + (output value previous to previous output value  $\times$  calculated coefficient).

81. *Why isolation circuitry is required to control the ac drives?*

To control 220V or 440V ac devices it is not desirable to have a common power circuit ground and control circuit ground. This is very important because if the 220V ac line gets shorted to the Vcc line of a microcomputer, it usually bakes most of the microcomputer ICs. To avoid this, the control circuit and power circuit is electrically isolated by separating their individual ground lines.