

MICROPROCESSORS& MICROCONTROLLERS

PART-A UNIT I-8085 PROCESSOR

1. What is microprocessor?

A microprocessor is a multipurpose, programmable, clock driven, register based electronic device that reads binary instructions from a storage device called memory, accepts binary data as input and processes data according to those instructions and provides results as output.

2. What are the basic units of microprocessor?

The basic units or blocks of microprocessor are

- ALU,
- Array of registers and
- Timing and Control unit.

3. What is the function of program counter in 8085 microprocessor?

A program counter is a register in a computer processor that contains the address (location) of the instruction being executed at the current time. As each instruction gets fetched, the program counter increases its stored value by 1. After each instruction is fetched, the program counter points to the next instruction in the sequence. When the computer restarts or is reset, the program counter normally reverts to 0.

4. What Is The Use Of Stack Pointer ?

The Stack Pointer is a register which holds the address of the next available spot on the stack. The stack is an area in memory which is reserved to store a stack, that is a LIFO (Last In First Out) type of container, where we store the local variables and return address, allowing a simple management of the nesting of function calls in a typical program.

5. What is a bus? (NOV 2011)

Bus is a group of conducting lines that carries data, address and control signals. The microprocessor always communicates with input/output devices and memory via some path called system bus.

6. Why data bus is bi-directional?

The microprocessor is to fetch (read) the data from memory or input device for processing and after processing it has to store (write) the data to memory or output devices. Hence the data bus is bi-directional.

7. Why address bus is unidirectional?

The address is an identification number used by the microprocessor to identify or access a memory location or input/output device. It is an output signal from the processor. Hence the address bus is unidirectional.

8. What is the signal classification of 8085

All the signals of 8085 can be classified into 6 groups

- Address bus
- Data bus
- Control and status signals
- Power supply and frequency signals
- Externally initiated signals
- Serial I/O ports

9. Specify the four control signals commonly used by the 8085 MPU.

Four Control Signals Used by 8085

- ALE(Address Latch Enable): The lines AD0-AD7 are multiplexed and the latching of the address bus is done by using external latch and ALE signal from 8085
- RD and WR: These signals are used to control the direction of the data flow between processor and memory or I/O device/port.
- IO/M,S0,S1: IO/M indicates whether IO operation or memory operation is being carried out.S0 and S1 indicate the type of machine cycle in progress.
- READY: It is used to check whether peripheral device is ready or not for data transfer.

10. What is the function of ALE Signal?

The ALE (Address latch enable) is a signal used to demultiplex the address and data lines using an external latch. It is used to enable the external latch.

11. What is the function of IO/M SIGNAL?

It is a status signal. It is used to differentiate between memory locations and I/O operations. When this signal is low (IO/M = 0) it denotes the memory related operations. When this signal is high (IO/M = 1) it denotes an I/O operation.

12. List the 8085 flags.

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

13. What is meant by level triggered interrupt and which of the interrupts in 8085 are level triggered?

A level-triggered interrupt is an interrupt signaled by maintaining the interrupt line at a high or low level. A device wishing to signal a Level-triggered interrupt drives the interrupt

request line to its active level (high or low), and then holds it at that level until it is serviced. It ceases asserting the line when the CPU commands it to or otherwise handles the condition that caused it to signal the interrupt.

TRAP,RST 5.5,RST 6.5,INTR-Level triggered interrupt.

14. Define machine cycle?

Machine cycle is defined as the time required to complete one operation of accessing memory input/output, or acknowledging an external request. This cycle may consists of three to six T-states.

15. Define T-state?

T-state is defined as one subdivision of operation performed in one clock period. These subdivisions are internal states synchronized with the system clock, and each T-state is precisely equal to one clock period.

16. What is an instruction cycle?

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

17. What is fetch and execute cycle?

The instruction cycle is divided in to 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.

18. What does memory-mapping mean?

The memory mapping is the process of interfacing memories to microprocessor and allocating addresses to each memory locations.

19. What is opcode fetch cycle?

The opcode fetch cycle is a machine cycle executed to fetch the opcode of an instruction stored in memory. Each instruction starts with opcode fetch machine cycle.

20. What is polling?

In polling, the microprocessor's software simply checks each of the I/O devices every so often. During this check, the microprocessor tests to see if any device needs servicing.

21. What are the different types of interrupts?

Hardware interrupts- The interrupts where the CPU pins are used to receive interrupt requests , are called hardware interrupts. TRAP,RST 7.5,RST 6.5,RST 5.5, INTR.

Software interrupts – This interrupt is caused by the execution of the instruction. These are special instructions supported by the microprocessor. RST 0,RST 1,RST 2,RST 3,RST 4,RST 5,RST 6,RST 7

22. What is the difference between memory mapped I/O and I/O mapped I/O?

memory mapped I/O	I/O I/Omapped I/O
This device address is 16 bit. Thus A0 to A15 lines are used to generate the device address.	.In This device address is 8 bit. Thus A0 to A7 or A8 to A15 lines are used to generate the device address.
MEMR and MEMW control signals are used to control read and write I/O operations	IOR and IOW control signals are used to control read and write I/O operations.

Instructions available are LDA,STA,MOV R,M .ADD M etc	Instructions available are IN and OUT
Data transfer is between any register and I/O device.	Data transfer is between accumulator and I/O device.
Decoding 16 bit address may require more hardware.	Decoding 8 bit address will require less hardware.

23. Describe the function of the following pins in 8085?

a) IO/M b) HOLD c)SID and SOD

- IO/M – indicates whether I/O operation or memory operation is being carried out.
- HOLD – This signal indicates that another master is requesting for the use of address bus, data bus and control bus.
- SID(Serial Input Data) – This input signal is used to accept serial data bit by bit from the external device.
- SOD(Serial Output Data) – This is an output signal which enables the transmission of serial data bit by bit to the external device.

24. What is Accumulator Register?

It is an 8 – bit register. It holds a source operand and receives the result of the arithmetic instructions (Addition, Subtraction, Multiplication and Division)

25. What is the significance of wait state generator?

This is used to transfer data between slower I/O device and the microprocessor. In some applns, the speed of I/O systems is not compatible with the microprocessor's timings. So the microprocessor has to confirm whether the peripheral is ready or not. If READY pin is high, the peripheral is ready otherwise 8085 enters in to wait state.

26. 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 from a microprocessor system.

27. 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.

28. How clock signals are generated in 8085 and what is the frequency of the internal clock?

The 8085 has the clock generation circuit on the chip but an external quartz crystal or LC circuit or RC circuit should be connected at the pins X1 and X2. The maximum internal clock frequency of 8085 is 3.03MHz.

29. List few applications of microprocessor-based system.

- For measurements, display and control of current, voltage, temperature, pressure, etc.
- For traffic control and industrial tool control.
- For speed control of machines.

30. What is a port? What are the different modes of 8085?

The port is a buffered I/O, which is used to hold the data transmitted from the microprocessor to I/O devices and vice versa.

31. What is the significant of PSEN and EA pin in 8051 microcontroller.

It is an active low I/P to **8051** microcontroller. When (EA)= 0, then **8051** microcontroller access from external program memory (ROM) only. When (EA) = 1, then it access internal and external program memories (ROMs). [PSEN(bar)]: ... It is used to enable external program memory (ROM)

UNIT II-PROGRAMMING OF 8085 PROCESSOR

1. What are the types of addressing modes of 8085.

- Immediate
- Direct
- Register
- Indirect
- Implied

2. What is meant by immediate addressing mode?

In an immediate addressing mode 8 or 16 bit data can be specified as a part of instruction. 'I' indicates the immediate addressing mode. Eg; MVI A, 20 H

3. What is meant by register addressing mode?

The register addressing mode specifies the source operand, destination operand, or both to be contained in an 8085 registers. This results in faster execution, since it is not necessary to access memory locations for operand. Eg : MOV A, B

4. What is meant by direct addressing mode?

The direct addressing mode specifies the 16 bit address of the operand within the instruction itself. The 2nd and 3rd bytes of the instruction contain this 16 bit address. Eg: LDA 2050 H

5. How are the 8085 instructions classified according to the functional categories? (N/D'11)

Data Transfer, Arithmetic, Logical, Branching, Machine Control.

6. What are the different control machine control instructions used in 8085 microprocessor? M/J 2013, MAY 2017

- EI-Enable Interrupt
- DI-Disable interrupt
- NOP- No operation
- HLT- Halt, SIM, RIM.

7. Mention the similarity and difference between compare and Subtract instructions

COMPARE: This instruction compares the given numbers by subtracting it and gives the result if the number is greater than, lesser than or equal to the status of sign and carry flag will be affected.

SUBTRACT: This instruction subtracts the two given numbers and the flag registers will not be affected.

8. State the purpose and importance of NOP instruction.

NOP – No operation. This instruction does not perform any operation. It can also be used to make the clock signals to go in wait state that is delay time can be increased.

9. What is the use of branching instructions? Give examples.

These instructions allow the processor to change the sequence of the program either conditionally or unconditionally or under certain test conditions. These include branch instructions, subroutine call and return instructions.

10. State the function of given 8085 instruction: JP, JPE, JPO, JNZ.

- JP – 16 bit Address – Jump on Plus
- JPE – 16 bit Address – Jump on Even Parity
- JPO – 16 bit address – Jump on Odd Parity
- JNZ – 16 bit address – Jump on No Zero

11. How is PUSH B instruction executed? Find the status after the execution .

This instruction decrements SP by one and copies the higher byte of the register pair into the memory location pointed by SP. Then decrements the SP again by one and copies the lower byte of the register pair into the memory location pointed by SP. Ex: SP=2000H, DE=1050H

12. Give two examples for two byte and three byte instruction.

- MVIA, 08
- IN CO.....2 byte instruction
- LDA 4500
- STA 5000.....3 byte instruction

13. What happens when the RET instruction at the end of the subroutine is executed? N/D2012(R2004)

This instruction pops the return address (address of the instruction next to the CALL instruction in the main program) from the stack and loads program counter with this return address. Thus transfers program control to the instruction next to Call in the main program.

14. What are the instructions associated with the subroutine.

CALL 16 bit address: The program sequence is transferred to the address specified by the operand. Before the transfer, the address of the next instruction to CALL (the contents of the program counter) is pushed to the stack.

RET - RETURN: The program sequence is transferred from the subroutine to the calling program. The two bytes from the top of the stack are copied into the program counter and the program execution begins at the new address. The instruction is equivalent to POP program counter.

15. What is the significance of 'XCHG' and 'SPHL' instructions?

'XCHG'-Exchange the contents of HL register pair with DE register pair i.e. the contents of register H are exchanged with the contents of register D and the contents of register L are exchanged with the contents of register E. 'SPHL'-store the contents of HL register pair to the stack pointer. The contents of H register provide the higher order address and the contents of L register provide the low order address. The contents of H and L registers are not altered.

16. What is the difference between SHLD and LHLD?

SHLD- Store HL register pair in memory. This instruction is used to store the contents of H and L register directly in to memory.

LHLD- Load HL register pair from memory. This instruction copies the contents of memory location given with in the instruction in to the L register and the contents of next memory location in to the H register.

17. What is the difference between STAX and LDAX?

STAX rp – Store the contents of Accumulator register (A) in memory location whose address is specified by BC or DE register pair.

LDAX rp – Load Accumulator register (A) with the contents of memory location whose address is specified by BC or DE register pair.

18. Write an assembly language program to transfer data from memory block B1 to memory block B2?

```
MVI C,0AH; Initialize counter
LXI H, 2200H; Initialize source memory pointer
LXI D, 2300H; Initialize destination memory pointer
Loop:  MOV A,M; Get byte from source memory block
      STAX D; Store byte in the destination memory block
      INX H; Increment source memory pointer
      INX D; Increment destination memory pointer
      DCR C; Decrement counter
      JNZ Loop ; If counter != 0 repeat
      HLT
```

19. Write an assembly language program to add 2 BCD numbers?

```
LXI H,2200H; Initialize pointer
MOV A,M ; Get the first number
INX H; Increment the pointer
ADD M ; Add two numbers
DAA ; Convert HEX to valid BCD
```

STA 2300; store the result
HLT

20. Explain the instruction LXI rp,data .

LXI rp, data(16) – Load 16 –bit immediate data to specified register pair or stack pointer.
The rp is 16 – bit register pairs such as BC, DE, HL or stack pointer.

21. Write the difference between LDA and STA instruction.

LDA – Load data in to Accumulator register(A) directly from the address specified with in the instruction.

STA – Store the contents of Accumulator register(A) to the address specified with in the instruction.

22. What is the function of stack?

Stack is a portion of Read /Write memory location set aside by the user for the purpose of storing the information temporarily. When the information is written on the stack the operation is PUSH and when the information is read from the stack it is POP. The type of operation performed in stack is LIFO(last in first out)

23. Why do we need look up table?

To store the complex parameters in the program memory. It reduces computational complexity. Eg: SINTable.

24. What is a stack in an 8085 microcomputer system.

Stack is a portion of Read /Write memory location set aside by the user for the purpose of storing the information temporarily. When the information is written on the stack the operation is PUSH and when the information is read from the stack it is POP. The type of operation performed in stack is LIFO last in first out.

25. Show the different instruction formats used in 8085. Give examples

- One byte instruction –CLR A
- Two byte instruction -MVIA, 00
- Three byte instruction-STA 5000

26. What is the significance of 'XCHG' and 'SPHL' instructions?

'XCHG'-Exchange the contents of HL register pair with DE register pair i.e. the contents of register H are exchanged with the contents of register D and the contents of register L are exchanged with the contents of register E

SPHL-store the contents of HL register pair to the stack pointer. The contents of H register provide the higher order address and the contents of L register provide the low order address. The contents of H and L registers are not altered

27. Differentiate between CALL / RET and PUSH / POP?

- CALL instruction stores the address of the next instruction
- PUSH instruction stores register contents in the stack
- RET instruction loads the address from stack into program counter
- POP instruction gets the register content from the stack

28. What do you mean by Looping, Counting and Indexing?

- Looping: In this tech the program is instructed to execute certain set of instructions repeatedly to execute a particular task number of times.
- Counting: This tech allows programmer to count how many times the ins of instruction are executed.
- Indexing: This tech allows programmer to point or refer the data stored in sequential memory location one by one.

29. Give the difference between JZ and JNZ?

JZ change the program sequence to the location specified by the 16-bit address if the zero flag is set and JNZ change the program sequence to the location specified by the 16-bit address if the zero flag is reset.

30. Define stack and subroutine?

Stack is a sequence of RAM memory locations defined by the programmer.

Subroutine: A set of instructions in a loop called from a main program to perform a definite operation and returns back to the main program after execution. Instructions are CALL & RET

31. What is meant by bit oriented instruction

ANL C, bit - AND direct bit to the carry flag

C: Carry flag

Bit: any bit of RAM

Description: Instruction performs logic AND operation between the direct bit and the carry flag.

EXAMPLE:

```
0222    ...  
0223    (Label)    ANL    C, ACC.7  
0224    ...
```

Before execution: ACC= 43h (01000011 Bin.)

C=1

After execution: ACC= 43h (01000011 Bin.)

C=0

UNIT III- 8051 MICROCONTROLLER

1. What is meant by micro controller?

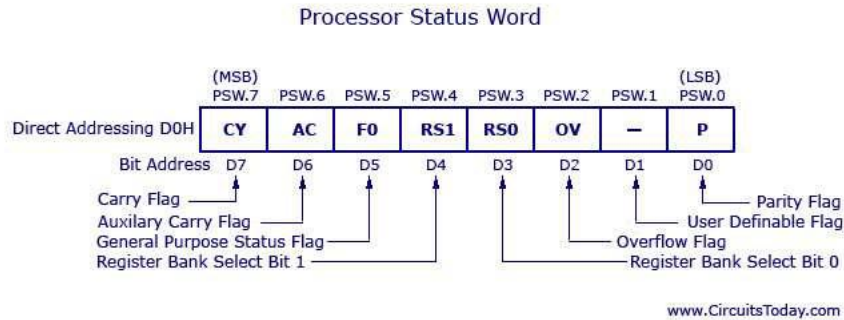
A device which contains the microprocessor with integrated peripherals like memory, serial ports, parallel ports, timer/counter, interrupt controller, data acquisition interfaces like ADC, DAC is called micro controller.

2. List the features of 8051 micro controllers?

- Single supply +5v operation using HMOS technology.
- 4096 bytes program memory on-chip.
- 128 data memory on chip.
- 4 register banks

- 2 multiple modes, 16 bit timer/counter
- Extensive Boolean processing capabilities.
- 64KB external RAM size.
- 32 bi-directional I/O lines.

3. Give the details of PSW register in 8051.



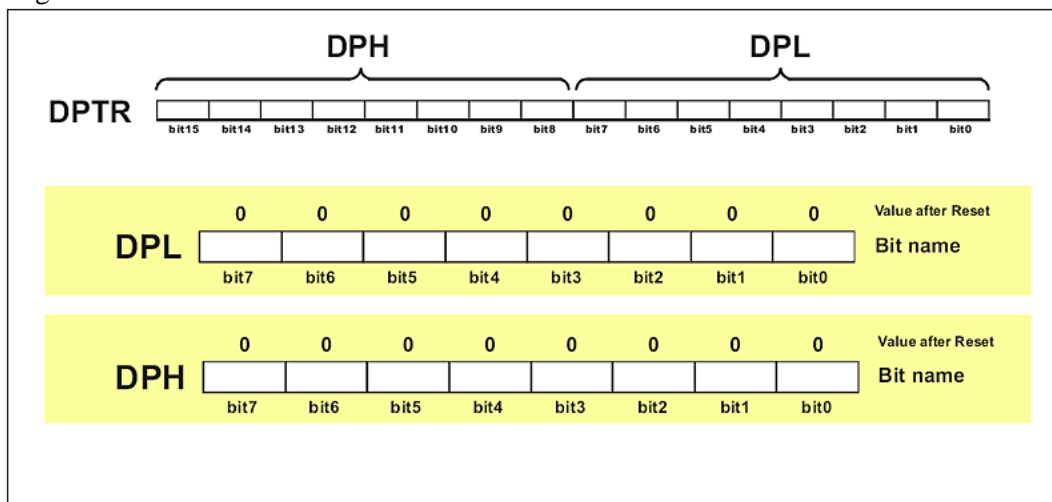
4. List the alternative functions assigned to Port 3 pins of 8051 microcontroller.

The alternative functions of PORT 3 pins are:

- P 3.0 (RXD) Serial data Input
- P 3.1 (TXD) Serial data Output
- P 3.2 (INT0) External Interrupt 0
- P 3.3 (INT1) External Interrupt 1
- P 3.4 (T0) External timer 0 Input
- P 3.5 (T1) External timer 1 Input
- P 3.6 (WR) External memory write pulse
- P 3.7 (RD) External memory read pulse

5. Mention the size of DPTR in 8051 microcontroller.

The Data Pointer (DPTR) is a 16 bit data Register and Stack pointer (SP) is 8 bit Register.



6. What are the addressing modes of 8051?

The addressing modes of 8051 are:

- Immediate.
- Register.
- Register indirect.
- Direct.
- Indexed.

7. What is the function of R register in 8051?

The 8051 uses 8 "R" registers which are used in many of its instructions. These "R" registers are numbered from 0 through 7 (R0, R1, R2, R3, R4, R5, R6, and R7). These registers are generally used to assist in manipulating values and moving data from one memory location to another.

8. Mention the purpose of PSEN and EA in 8051 microcontroller.

PSEN: If external ROM is used for storing program then a logic zero (0) appears on it every time the microcontroller reads a byte from memory.

EA: By applying logic zero to this pin, P2 and P3 are used for data and address transmission with no regard to whether there is internal memory or not. It means that even there is a program written to the microcontroller, it will not be executed. Instead, the program written to external ROM will be executed. By applying logic one to the EA pin, the microcontroller will use both memories, first internal then external (if exists).

9. List the interrupt sources in 8051.

There are 5 interrupts which occur in 8051

3 Internal Interrupts provided by

- Timer flag 0
- Timer flag 1
- Serial port interrupt (R1 /T1)

2 External Interrupt provided by

- (PORT PIN 3.2)
- (PORT PIN 3.3)

10. List the on-chip peripherals of 8051 microcontroller.

- Program memory
- data memory
- 4 parallel ports
- serial port
- timers and
- interrupt controller

11. How many ports are bit addressable in 8051 microcontroller.

P0, P1, P2 & P3 (all the four ports are bit addressable)

12. Give an example of DA instruction of 8051 microcontroller.

The DA (decimal adjust for addition) instruction in the 8051 is provided to correct the aforementioned problem associated with BCD addition. The mnemonic "DA" has as its only operand the accumulator "A". The DA instruction will add 6 to the lower nibble or higher nibble if needed; otherwise, it will leave the result alone. The following example will clarify these points.

MOV A,#47H

MOV B,#25H

ADD A,B
DA A

After the program is executed, register A will contain 72H ($47 + 25 = 72$). The “DA” instruction works only on A. In other words, while the source can be an operand of any addressing mode, the destination must be in register A in order for DA to work. It also needs to be emphasized that DA must be used after the addition of BCD operands and that BCD operands can never have any digit greater than 9. In other words, A – F digits are not allowed. It is also important to note that DA works only after an ADD instruction; it will not work after the INC instruction.

13. Explain the mode3 of 8051 serial ports?

In this mode, 11 bits are transmitted (through TXD) or received (through RXD): a start bit(0), 8 data bits (LSB first), a programmable 9th data bit, & a stop bit(1). In fact, Mode3 is the same as Mode2 in all respects except the baud rate. The baud rate in Mode3 is variable. In all the four modes, transmission is initiated by any instruction that uses SBUF as a destination register. Reception is initiated in Mode0 by the condition $RI=0 \& REN=1$. Reception is initiated in other modes by the incoming start bit if $REN=1$.

14. Write A program to perform multiplication of 2 no's using 8051?

```
MOV A, data 1
MOV B, #data 2
MUL AB
MOV DPTR, #5000
MOV @DPTR, A (lower value)
INC DPTR
MOV A, B
MOVX @ DPTR, A
```

15. What is memory mapping?

Memory mapping may refer to: Memory-mapped file, also known as mmap() Memory-mapped I/O, an alternative to port I/O; a communication between CPU and peripheral device using the same instructions, and same bus, as between CPU and memory Virtual memory, technique which gives an application program the impression that it has contiguous working memory, while in fact it is physically fragmented and may even overflow on to disk storage.

16. What is USART?

USART is Universal Synchronous-Asynchronous Receiver Transmitter. is a microchip that facilitates communication through a computer's serial port using the RS-232C protocol.

17. Explain the operating mode 0 of 8051 serial port?

In this mode serial data enters and exists through RXD, TXD outputs the shift clock. 8-bits are transmitted or received: 8-data bits (LSB first). The baud rate is fixed at $1/12$ the oscillator frequency.

18. Explain the operating mode 2 of 8051 serial port?

In this mode 11 bits are transmitted (through TXD) or received (through (RXD)): a start bit(0), 8 data bits (LSB first), a programmable 9th data bit and a stop bit(1). On transmit, the 9th

data bit can be assigned the value 0 or 1. On receive, the 9th data bit goes into the RB8 in special function register SCON, while the stop bit is ignored. The baud rate is programmable to either 1/32 or 1/64 the oscillator frequency.

19. Explain the interrupts of 8051 micro controller?

External interrupt 0 (IE0) – Highest priority

Timer interrupt 0 (TF0)

External interrupt 1 (IE1)

Timer interrupt 1 (TF1)

Serial port Interrupt

Receive interrupt (RI) – lowest priority

Transmit interrupt (TI)

20. Define machine cycle of 8051?

8051 machine cycle consists of 6 states, S1 through S7. One state is made up of 2 clock pulses. Thus 12 clock periods constitute one machine cycle. Two clock periods in a state are termed as phase 1 and phase 2.

21. What are the special functions of port 0 of 8051?

Port 0 is used as a multiplexed low order address/data bus during the external memory access. When ALE is enabled, the address on port 0 pins is latched and bus is ready to act as a data bus when ALE is low.

22. What are the flags supported by 8051 controller?

- Carry flag
- Auxiliary carry flag
- Overflow flag
- General purpose user flag
- Register bank select bit one
- Register bank select bit zero
- Parity flag

23. What is meant by Power-on-Reset in 8051 controller?

When RESET pin is activated, the 8051 jumps to address location 0000H. This is called as Power-on-Reset. Reset pin is considered as a sixth interrupt source of 8051.

24. What are the significance of SFRs?

SFRs denote Special Function Registers of 8051 controller. All the controller registers such as port latches, timer register, peripheral control register, accumulator, PC and DPTR are available in SFR region.

25. What are the different groups of instructions supported by 8051?

- Data Transfer Group
- Arithmetic Group
- Logical Group
- Branching Group
- Bit manipulation Group

26. What is a Data pointer register?

The data pointer register (DPTR) consists of a high byte (DPH) and a low byte (DPL) functions to hold 16-bit address. It may be manipulated as a 16-bit data register or as independent

8-bit registers. It serves as a base register in indirect jumps, look up table instructions and external data transfer.

27. What is the use of SWAP function in 8051?

SWAP A : Swap nibbles with in the Accumulator bytes. It interchanges the low and high order nibbles of the Accumulator (bits 0-3 and bits 4-7)

28. What is SCON?

SCON is the serial port control register, which contains not only the mode selection bits (SM0 – SM2, REN), but also the 9th data bit for transmit and receive (TB8 and RB8) and the serial port interrupt bits (TI and RI).

SM0 – Serial port mode control bit 0

SM1 – Serial port mode control bit 1

SM2 – Serial port mode control bit 2

REN – Receiver enable control bit

TB8 – Transmit bit 8

RB8 – Receive bit 8

TI – Transmit Interrupt flag

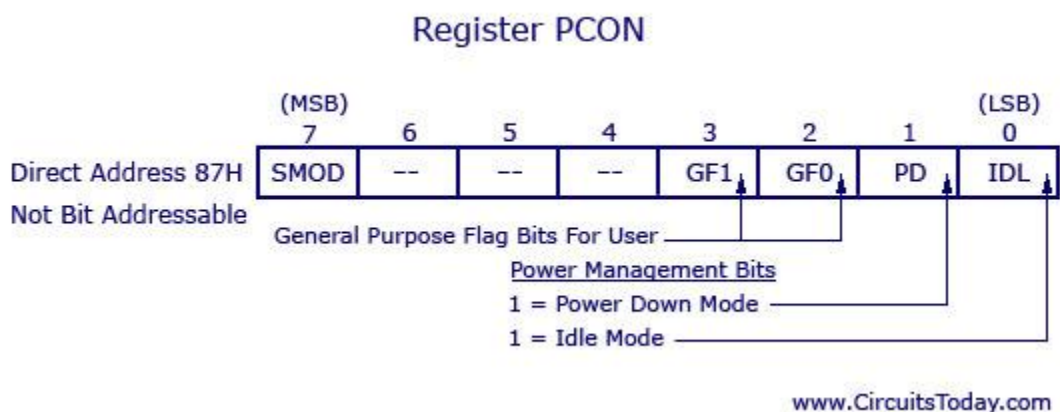
RI – Receive interrupt flag

29. Mention two applications of microcontroller.

Keyboard interface, simple keyboard, matrix keyboard-display interface, LED, LCD, dc servo motor, washing machine control, stepper motor.

30. What is PCON register?

PCON – Power Control Register As the name indicates, this register is used for efficient power management of 8051 micro controller. Commonly referred to as PCON register, this is a dedicated SFR for power management alone. From the figure below it can be observed that there are 2 modes for this register :- Idle mode and Power down mode. Setting bit 0 will move the micro controller to Idle mode and Setting bit 1 will move the micro controller to Power down mode.



31. Explain the function of DJNZ instruction .

The **DJNZ** instruction decrements the byte indicated by the first operand and, if the resulting value is not zero, branches to the address specified in the second operand.

DJNZ direct, offset

C	AC	F0	RS1	RS0	OV		P
---	----	----	-----	-----	----	--	---

Bytes 3

Cycles 2

Encoding

11010101

direct

offset

Operation

DJNZ

PC = PC + 2

(direct) = (direct) - 1

IF (direct) <> 0

PC = PC + offset

Example DJNZ 40h, LABEL

UNIT – IV: PERIPHERAL INTERFACING

1. What is programmable peripheral device?

If the function performed by the peripheral device can be altered or changed by a program instruction then the peripheral device is called programmable device. It has a control register. The device can be programmed by sending control word in the prescribed format to the control register.

2. What are the different ways to end the interrupt execution in 8259 PIC?

AEIOI (Automatic End of Interrupt) mode the ISR bit is reset at the end of the second INTA pulse. Otherwise, the ISR bit remains set until the issue of an appropriate EOI command at the end of the interrupt subroutine.

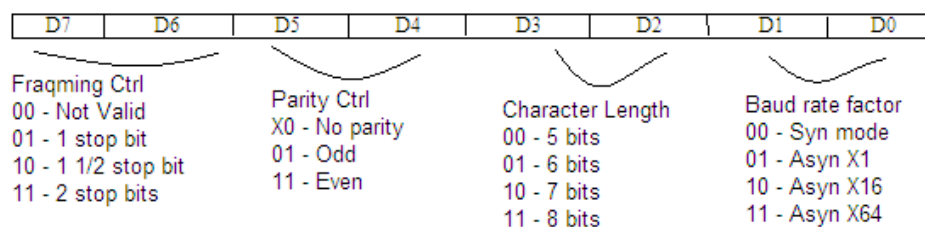
3. What is the function of Scan section in 8279 programmable keyboard/Display controller?

Scan section which has two modes (i) Encoded Mode (ii) Decoded Mode

Encoded Mode: In this mode, Scan counter provides a binary count from 0000 to 1111 the four scan lines (SC3 – SC0) with active high outputs.

Decoded Mode: The internal decoder decodes the least significant 2 bits of binary count and provides four possible combinations on the scan lines (SC3- SC0) : 1110, 1101, 1011 and 0111.

4. Draw the 'mode word' format of 8251 USART.



5. State the use of ISR and PR registers in 8259 PIC.

ISR- Interrupt service Register Stores all the levels that are currently being serviced.

PR- Priority Resolver determines the priorities of the bits set in the IRR (Interrupt Request register). The bit corresponding to the highest priority interrupt input is set in the ISR during the INTA input.

6. What are the salient features of INTEL 8259 Programmable interrupt controller?

- It manages eight Priority interrupt request.
- The interrupt vector addresses are programmable.
The 8259 are programmed to accept either the level triggered or edge triggered interrupt request.
- The interrupt can be masked or unmasked individually.
- 8259 helps to get the information of pending interrupts, in-service interrupt and masked interrupts

7. What are the features of INTEL 8259?

1. It manages 8 interrupt request.
2. The interrupt vector addresses are programmable.
3. The priorities of interrupts are programmable.
4. The interrupt can be masked or unmasked individually.

8. How data is transmitted in asynchronous serial communication?

Data is transmitted by setting transmission enable bit in the command instruction. When transmitter is enabled and CTS = 0 the transmitter is ready to transfer data on Tx D line. The data bits are framed with one start bit and stop bits and then transmitted.

9. What are the applications of D/A converter interfacing with 8255?

Generating square, triangular and sine waveform, used in automatic process control

10. What is keyboard interfacing?

Keyboard interfacing is interfacing an input device. Push button switches are used. In simple keyboard interface one input line is required to interface one key and this number will increase with number of keys. It is in the form of matrix with rows and columns and at the intersection a switch is present.

11. What are the different peripheral interfacing used with 8085 processor?

8255 PPI, 8279 Keyboard and display controller, 8251 USART, 8259 PIC and 8254 - timer

12. What is the need for 8259 PIC?

It is necessary to solve multiple interrupt requests (more than five) we use an external device called a PIC. It is possible to increase the interrupt handling capacity of the microprocessor. When executing an interrupt an ISR can be serviced.

13. What are the basic modes of 8255?

- BSR mode
- I/O mode which is operated in mode 0, mode 1 and mode 2

14. What are the operating modes of IC 8253 / 8254 Timer?

There are 6 operating modes in IC 8254 Timer they are

- Mode 0: Interrupt on Terminal Count
- Mode 1: Hardware – Triggered one shot
- Mode 2 – Rate Generator
- Mode 3 – Square wave generator
- Mode 4 – Software triggered strobe
- Mode 5- Hardware triggered strobe

15. What is key de bouncing?

The push button keys when pressed, bounces a few times, closing and opening the contact before providing a steady reading. The reading taken during the bouncing period may be wrong. Therefore, microprocessor must wait until the key reaches a steady state known as keydebounce.

16. What is the difference between A/D and D/A converters?

Digital-to-analog is used to get a proportional analog voltage or current for the digital data given out by the microprocessor. An ADC converts the input analog voltage levels to the corresponding discrete digital signals.

17. Define the following terms for D/A converters.

Resolution: Resolution of a converter determines the degree of accuracy in conversion. It is equal to $1/2^n$.

Accuracy: Accuracy is the degree to which information on a map or in a digital database matches true or accepted values. Accuracy is an issue pertaining to the quality of data and the number of errors contained in a dataset or map.

Monotonicity : If a clock has monotonicity, then each successive time reading from that clock will yield a time further in the future than the previous reading.

Conversion time: The time required by an analog to digital converter to fully convert an analog input sample.

18. List the features of 8279.

- It has built in hardware to provide key debounce.
- It provides two output modes for display interface : Left and Right entry
- It provides three input modes for keyboard interface: Scanned keyboard Mode, Scanned sensor matrix mode and strobed input mode.
- It provides multiplexed display interface with blanking and inhibit options.

19. What is the function of the GATE signal in timer 8254?

In timer 8254, the GATE signal acts as a control signal to start, stop or maintain the counting process. In modes 0, 2, 3, and 4 the GATE signal should remain high to start and maintain the counting process. In modes 1 and 5, GATE signal has to make low to high transitions to start the counting process and need not remain high to maintain the counting process.

20. What is meant by Baud rate?

The rate at which the serial data is being transferred is called Baud rate.

21. What is meant by doubling the baud rate in the 8051?

We can double the baud rate in 8051 using two ways

By doubling the crystal frequency.

By making SMOD bit in the PCON register from 0 to 1.

22. What is the function of C/T bit in TMOD register in timer in 8051?

C/T bit in the TMOD register decides the timer/counter functioning as a counter or a timer. When $C/T = 0$, the timer mode is selected and the crystal is used as a source of frequency. When $C/T = 1$, the counter mode is selected, it gets its pulse from outside the 8051. The counter counts up for each clock pulse applied at the pins of port 3.

23. What is meant by Handshake signals in 8255 PPI?

The MPU and peripherals operate at different speeds; signals are exchanged prior to data transfer between the fast responding MPU and slow responding peripherals such as printer and data converters. These signals are called Handshake signals.

24. What is meant by Over Run error (OE), Parity error (PE) and framing error (FE) in 8251 PCI?

Over Run Error: The OE flag is set when the CPU does not read a character before the next one becomes available. It is reset by the Error reset (ER) bit in the command instruction. OE does not inhibit operation of the 8251. However the previously over run character is lost.

Parity Error (PE): The PE flag is set when a parity error is detected. It is reset by the ER bit of the command instruction. PE does not inhibit operation of the 8251.

Framing Error: The FE flag is set when a valid stop bit is not detected at the end of every character. It is reset by the ER bit of the command instruction. FE does not inhibit the operation of the 8251.

25. How does a serial communication classified?

The serial communication is classified according to the direction and data flow as Simplex transmission - data transmitted in only one direction, eg - transmission from a microcomputer to a printer. Duplex Transmission - data flows in both directions. If data gets transmitted one way at a time called as half duplex and if data gets transmitted in both directions called as full duplex. Eg transmission between two computers, between a computer and a terminal.

26. What are the types of priority modes in 8259 PIC?

Fully Nested Mode, Automatic rotation mode, specific rotation mode and end of Interrupt.

27. What is meant by two key lockout and N key roll over in 8279?

The keys are automatically de-bounced and the keyboard can operate in two modes:

Two key Lock out - In this mode if two keys are pressed almost simultaneously, only the first key is recognized.

N key roll over - In this mode simultaneous keys are recognized and their codes are stored in the internal buffer; it can also be set up so that no key is recognized until one key remains pressed.

28. Explain the Mode 3 of 8051 serial ports?

In this mode, 11 bits are transmitted (through TXD) or received (through RXD): a start bit (0), 8 data bits (LSB first), a programmable 9th data bit, & a stop bit (1). In fact, Mode 3 is same as Mode 2 in all respects except the baud rate. The baud rate in Mode 3 is variable. In all the four modes, transmission is initiated by any instruction that uses SBUF as a destination register. Reception is initiated in Mode 0 by the condition $RI=0$ & $REN=1$. Reception is initiated in other modes by the incoming start bit if $REN=1$.

29. List the operating Modes of 8255A PPI?

- Two 8-bit ports (A and B)

- Two 4-bit ports (Cu and CL)
- Data bus buffer
- Control logic

30. How data is transmitted in asynchronous serial communication?

- 1.Start signal is sent prior to each byte, character or code word and a stop signal is sent after each code word
- .2.The start signal serves to prepare the receiving mechanism for the reception and registration of a symbol
- .3.The stop signal serves to bring the receiving mechanism to rest in preparation for the reception of the next symbol.
- 4.Used to transfer one character at a time.
- 5.Speed is less
- 6.Transmitter & receiver can use separate clock pulse.

31.What is meant by cascading in 8259 iv

The cascade pins (CAS0, CAS1 and CAS2) from the master are connected to the corresponding pins of the slave.For the slave 8259, the SP (low) / EN (low) pin is tied low to let the device know that it is a slave.The SP (low) / EN (low) pin can be used as input or output signal.

In non-buffered mode it is used as input signal and tied to logic-1 in master 8259 and logic-0 in slave 8259.In buffered mode it is used as output signal to disable the data buffers while data is transferred from 8259A to the CPU.

UNIT – V: MICRO CONTROLLER PROGRAMMING & APPLICATIONS

1. List the different types of 8051 instructions.

The different types of 8051 instructions are:

- Logical Instructions
- Arithmetic Instructions
- Data transfer Instructions
- Branch Instructions
- Jump & CALL Instruction

2. What are the various operations performed by Boolean variable instructions of 8051?

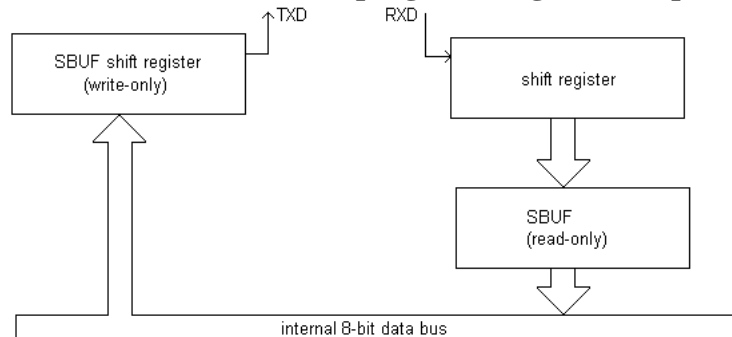
Boolean variable instructions perform the following operations

- AND(AND logical) ANL
- OR(OR logical) ORL
- NOT(COMPLEMENT) CPL
- XOR(Exclusive OR logical) XRL

3. What is the operation of the given 8051 microcontroller instructions: XRL A, direct?

XOR each bit of A with the same bit of the direct RAM address and the result is stored in A(Acc).

4. Draw the flow chart for the programming of serial port of 8051.



5. What are the applications of 8051 microcontroller?

The applications of 8051 microcontroller are:

- Automobile
- Aeronautics
- Mobile communication
- Robotics
- Remote sensing etc.,

6. How is the pulse generated from microcontroller for stepper motor control

To cause the stepper to rotate, we have to send a pulse to each coil in turn. The 8051 does not have sufficient drive capability on its output to drive each coil, so there are a number of ways to drive a stepper. Stepper motors are usually controlled by transistor or driver IC like ULN2003. Driving current for each coil is then needed about 60mA at +5V supply.

7. State the functions performed by the instructions JBC and CJNE in 8051 microcontroller.

Operation:	JBC
Function:	Jump if Bit Set and Clear Bit
Syntax:	JB bit addr, reladdr

Instructions	OpCode	Bytes	Cycles	Flags
JBC bit addr,reladdr	0x10	3	2	None

Description: JBC will branch to the address indicated by reladdr if the bit indicated by bit addr is set. Before branching to reladdr the instruction will clear the indicated bit. If the bit is not set program execution continues with the instruction following the JBC instruction.

Operation: CJNE

Function: Compare and Jump If Not Equal

Syntax: CJNE operand1,operand2,reladdr

Instructions	OpCode	Bytes	Cycles	Flags
CJNE A,#data,reladdr	0xB4	3	2	C
CJNE A,iramaddr,reladdr	0xB5	3	2	C
CJNE @R0,#data,reladdr	0xB6	3	2	C
CJNE @R1,#data,reladdr	0xB7	3	2	C
CJNE R0,#data,reladdr	0xB8	3	2	C
CJNE R1,#data,reladdr	0xB9	3	2	C
CJNE R2,#data,reladdr	0xBA	3	2	C
CJNE R3,#data,reladdr	0xBB	3	2	C
CJNE R4,#data,reladdr	0xBC	3	2	C
CJNE R5,#data,reladdr	0xBD	3	2	C
CJNE R6,#data,reladdr	0xBE	3	2	C
CJNE R7,#data,reladdr	0xBF	3	2	C

Description: CJNE compares the value of operand1 and operand2 and branches to the indicated relative address if operand1 and operand2 are not equal. If the two operands are equal program flow continues with the instruction following the CJNE instruction. The Carry bit (C) is set if operand1 is less than operand2, otherwise it is cleared.

8. Why do we need opto-isolator circuit between microcontroller and the stepper motor?

Opto-isolator are widely used to isolate the stepper motor's EMF voltage and keep it from damaging the digital microcontroller system.

9. Why interfacing is needed for I/O devices?

Generally I/O devices are slow devices. Therefore the speed of I/O devices does not match with the speed of microprocessor. And so an interface is provided between system bus and I/O devices.

10. What is the operation carried out when 8051 executes the instruction MOVC A, @A +DPTR?

This instruction loads the accumulator from the contents of program memory whose address is given by the sum of the contents of accumulator and contents of DPTR register $(A) \leftarrow ((A) + (DPTR))$

11. Write program to load accumulator, DPH, &DPL using 8051?

```
MOV A,#30
MOV DPH, A
MOV DPL, A
```

12. Write a program to perform multiplication of 2 numbers using 8051?

```
MOV A,#data 1
MOV B,#data 2
MUL AB
MOV DPTR,#5000
MOV @DPTR,A(lower value)
INC DPTR
MOV A,B
MOVX @ DPTR,A
```

13. Write a program to mask the 0th & 7th bit using 8051?

```
MOV A,#data
ANL A,#81
MOV DPTR,#4500
MOVX @DPTR,A
LOOP SJMP LOOP
```

14. Write a program to subtract 2 8-bit numbers &exchange the digits using 8051?

```
MOV A,#9F
MOV R0,#40
SUBB A,R0
SWAP A
```

15. Explain PUSH and POP instructions in 8051.

PUSH-The stack pointer is incremented by one. The contents of the indicated variable is then copied into the internal RAM location addressed by the stack pointer.

POP-Reverse of PUSH operation.

16. How many ports are bit addressable in an 8051 microcontroller?

In 8051 there are many bit-addressable registers such as A (ACC), B, SCON, PCON, TCON, p0, p1, p2, p3.

17. Write a program to find the 2's complement using 8051.

```
MOV A, R0
CPL A
INC A
```

18. Explain rotate instructions of 8051.

```
RL A,
RLC A,
RR A,
RRC A
```

19. What does the mnemonics "LCALL" and "ACALL" stands for?

There are two subroutine CALL instructions. They are LCALL (Long CALL) ACALL(Absolute CALL). Each increments the PC to the 1st byte of the instruction & push them in to the stack.

20. What are the use of PWM in motor control using microcontroller?

The speed of the dc motor depends on the applied voltage. The average applied dc voltage and power can be varied using a technique called pulse width modulation. In this technique the dc power supply is not a voltage of fixed amplitude ie it is a pulsating DC voltage. By changing the pulse width we can change the applied power.

21. List the features of ADC0804?

- 8-bit successive approximation ADC
- Access time is 135ns
- Conversion time is 100µs
- It has an on chip clock generator
- It does not require any zero adjustment
- It operates on single 5V power supply.

22. What is the output of the program?

```
MOV R0, A
XRL A, # 3F H
XRL A, R0
```

The contents of A register will be 3F H and the contents of R0 will be the initial contents of A.

23. What are the different addressing modes of microcontroller 8051?

- Register addressing
- Direct byte addressing
- Register indirect addressing
- Immediate addressing
- Register specific
- Index

24. Give the PSW setting for making register bank 2 as default register bank in 8051 microcontroller .

```
MOV PSW, #10 ; SELECT BANK 2
MOV A, R0 ; (A) ← (R0) FROM BANK 2
MOV PSW, #00 ; SELECT BANK 0
CLR C ; CLEAR CARRY
SUBB A, R1 ; A ← A- (R1) FROM BANK 0
```

The above program is to subtract the contents of R1 of BANK0 from the contents of R0 of Bank 2.

25. What is program status word?

- 1.The program status word (PSW) register is an 8-bit register.
- 2.It is also referred to as the *flag register*.
- 3.The 6 bits of it are used by the 8051.
- 4.The two unused bits are user-definable flags.
- 5.Four of the flags are called *conditional flags*, meaning that they indicate some conditions that result after an instruction is executed. They are CY (carry), AC (auxiliary carry), P (parity), and OV (overflow).The bits PSW.3 and PSW.4 are designated as RSO and RSI, respectively, and are used to change the bank registers.
- 6.The PSW.5 and PSW.1 bits are general-purpose status flag bits and can be used by the programmer for any purpose. In other words, they are user definable.

26. Write a program using 8051 assembly language to change the data 55 stored in the lower byte of the data pointer register to AA using rotate instruction?

```
MOV DPL,#55H
MOV A,DPL
RL A
LABEL : SJMP Label
```

27. Write a program to load accumulator a,DPH and DPL with 30H?

```
MOV A,#30
MOV DPH,A
MOV DPL,A 4.
```

28. Write a program to perform multiplication of 2 nos using 8051?

```
MOV A,#data 1
MOV B,#data 2
MUL AB MOV DPTR,#5000
MOV @DPTR,A(lower value)
INC DPTR
MOV A,B
MOVX@DPTR,A
```

29. What is meant by Power-on- Reset in 8051 controller?

When RESET pin is activated, the 8051 jumps to address location 0000H. This is called as Power-on-Reset. Reset pin is considered as a sixth interrupt source of 8051.

30. What are the significance of SFRs?

SFRs denotes Special function Registers of 8051 controller. All the controller registers such as port latches, timer register, peripheral control register, accumulator, PC and DPTR all are available in SFR region.

PART – B

BOOKS REFERRED FOR THE FOLLOWING QUESTIONS

- T1:** Krishna Kant, “Microprocessor and Microcontrollers”, Eastern Company Edition, Prentice Hall of India, New Delhi , 2007.
- T2:** R.S. Gaonkar, ‘Microprocessor Architecture Programming and Application’, with 8085, Wiley Eastern Ltd., New Delhi, 2013.
- T3:** Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085,8086,8051,McGraw Hill Edu,2013.

REFERENCES:

- R1:** Muhammad Ali Mazidi& Janice GilliMazidi, R.D.Kinely ‘The 8051 Micro Controller and Embedded Systems’, PHI Pearson Education, 5th Indian reprint, 2003.
- R2:** N.Senthil Kumar, M.Saravanan, S.Jeevananthan, ‘Microprocessors and Microcontrollers’, Oxford, 2013.
- R3:** Valder – Perez, “Microcontroller – Fundamentals and Applications with Pic,” Yeesdee Publishers, Tayler & Francis, 2013.

UNIT-I-8085 PROCESSOR

1. With Neat diagram, explain the Architecture of 8085?

ANS:Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085,8086,8051,McGraw Hill Edu,2013.[18-28]

2. Draw the pin diagram of 8085 and Explain the signal configuration of 8085 and explain the purpose of each signal

ANS: Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085,8086,8051,McGraw Hill Edu,2013.[[28-33]

3. Using peripheral mapped I/O, design a seven segment LED output port with device address of F2H using necessary control ICs. Draw the schematic and write 8085 ALP for displaying digit 8.

4. (a). Distinguish between peripheral mapped I/O and memory mapped I/O technique.

ANS: Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085,8086,8051,McGraw Hill Edu,2013.[[326]

- (b). Draw the interfacing circuit used to connect 64KB RAM with 8085 microprocessor and explain.

ANS: Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085,8086,8051,McGraw Hill Edu,2013.[[18-28]

5. Draw the timing diagram of memory read, memory write and opcode fetch cycles in 8085 microprocessor and explain

ANS: Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085,8086,8051,McGraw Hill Edu,2013.[[66-74]

6. (a). Explain the interrupt structure of 8085? [(MAY 2013,2017), (NOV 2010,2013,2015)]

- (b). Explain the 8085 interrupts system in detail.[(MAY 2011,2012,2014), (NOV 2012)]

ANS: Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085,8086,8051,McGraw Hill Edu,2013.[[336-348]

UNIT-II-PROGRAMMING OF 8085 MICROPROCESSOR

1. (a).Explain the instruction set of 8085.

ANS: Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085,8086,8051,McGraw Hill Edu,2013.[[40-63]

- (b).Describe with suitable example the data transfer instruction in 8085 microprocessor

ANS: Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture,Programming& Interfacing using 8085,8086,8051,McGraw Hill Edu,2013.[[46-48]

- (c).Describe the categories of instructions used for data manipulation in 8085 microprocessor.

ANS: Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085,8086,8051,McGraw Hill Edu,2013.[[48-55]

2. Explain the types of Addressing modes of 8085?

ANS: Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085,8086,8051,McGraw Hill Edu,2013.[[37-39]

3. With suitable illustrations explain the concept of look up tables in 8085 microprocessor.

4. Explain the operation of stack and subroutines in 8085 microprocessor.

ANS: Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085,8086,8051,McGraw Hill Edu,2013.[[87-91]

5. Explain the sequence of events in the execution of CALL and RET instructions.

ANS: Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085,8086,8051,McGraw Hill Edu,2013.[[57-58]

QUESTIONS ON ASSEMBLY LANGUAGE PROGRAMMING IN 8085.

6. Describe the 8085 Assembly language program for the loop structure with counting of 10 numbers.

7. Using look up table method write a program to find the cube of given number.

8. Write the 8085 Assembly language program to sort a set of numbers in ascending order?

9. Describe the Assembly language program the use of subroutines instructions.

10. Write an 8085 Assembly language program to add 16 bit numbers.

11. Write an assembly language program for (i) adding set of n numbers
(ii) to generate Fibonacci series using subroutines.

12. Write an assembly language program to generate the delay of 1ms. show the calculations.

13. Write an assembly language program to divide 8 bit numbers by another 8 bit number and store the remainder and quotient in memory locations 4252 and 4253 respectively.

14. Write an assembly language program to solve the following equation: $Z=2X+Y$ where X and Y stored in memory locations in 4200 and 4201 respectively. The value of Z stored in memory address 4202(lower byte) and 4203(higher byte).

15. Write an assembly language program to find the odd numbers in a given array of 10 numbers.

16. Write the Assembly language program to sort a set of numbers in ascending order?

17. Write the 8085 Assembly language program to find the biggest number in a block of data stored in the memory address 70H to 7F H?

18. Write an Assembly language program to add two BCD numbers?

19. Write 8085 ALP to perform 16 bit addition of 2 numbers from location 4100H and 4102H using 16 bit move and arithmetic instructions and save the result from the next memory location.
20. Write a program to arrange N numbers in ascending order.
21. Write an 8085 assembly language program to generate a time delay of 1ms. Show the calculations.
22. Write an assembly language program to calculate and store in the results as mentioned. Five memory locations 2401H, 2404H, 2404H & 2405H have data called X1, X2, X3, X4, X5.
 $(2405H) = X1 + X2 + X3 + X4$.
 $(2403H) = X5 - X3 - X2 - X1$.

UNIT III- 8051 MICROCONTROLLER

1. Describe the architecture of 8051 with neat diagram.
ANS: Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085, 8086, 8051, McGraw Hill Edu, 2013. **[725-730]**
2. Draw the pin diagram of 8051 microcontroller and explain its port structure. / With the help of functional block diagram explain the various signals present in 8051..
ANS: Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085, 8086, 8051, McGraw Hill Edu, 2013. **[735-743]**
3. Discuss about the organization of internal RAM and special function registers of 8051 microcontroller in detail. / Explain the program memory and data memory structure of 8051 microcontroller. (N/D'11) / Explain program memory interfacing in 8051 microcomputer.
ANS: Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085, 8086, 8051, McGraw Hill Edu, 2013. **[730-735]**, Krishna Kant, "Microprocessor and Microcontrollers", Eastern Company Edition, Prentice Hall of India, New Delhi, 2007. **[442-446]**
4. Explain the interrupt structure with the associated registers in 8051 microcontroller. / Explain the interrupt structure, SFR and timers of 8051.
ANS: Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085, 8086, 8051, McGraw Hill Edu, 2013. **[756-760]**
5. Explain the different modes of operation of timer unit in 8051? also Draw the TMOD register format and explain the different operating modes of timer in 8051 microcontroller.
ANS: Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085, 8086, 8051, McGraw Hill Edu, 2013. **[744-748]**
6. Explain the I/O ports and their functions of 8051 microcontroller and how serial communication is performed in 8051 microcontroller.
ANS: Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085, 8086, 8051, McGraw Hill Edu, 2013. **[739-743], [749-756]**

UNIT – IV: PERIPHERAL INTERFACING

1. With neat block diagram explain 8255 PPI. Using model, write a program to communicate between two microprocessors using 8255 and also Show the control word format of 8255 and explain how each bit is programmed./ Explain the operation of 8255 PPI port A programmed as input and output in mode 1 with necessary handshaking signals.

ANS: R.S. Gaonkar, 'Microprocessor Architecture Programming and Application', with 8085, Wiley Eastern Ltd., New Delhi, 2013[**460-479**]

2. With neat block diagram explain the functions of 8259.**ANS:** R.S. Gaonkar, 'Microprocessor Architecture Programming and Application', with 8085, Wiley Eastern Ltd., New Delhi, 2013[**505-513**]

3. Explain the functional block diagram of 8279.

ANS: R.S. Gaonkar, 'Microprocessor Architecture Programming and Application', with 8085, Wiley Eastern Ltd., New Delhi, 2013[**450-456**]

4. With functional diagram, explain the operation and programming of 8251 USART in detail.

ANS: R.S. Gaonkar, 'Microprocessor Architecture Programming and Application', with 8085, Wiley Eastern Ltd., New Delhi, 2013[**542-546**]

5. Draw the control word of 8253 timer/counter and explain the operating modes of 8253 timer/counter.

ANS: R.S. Gaonkar, 'Microprocessor Architecture Programming and Application', with 8085, Wiley Eastern Ltd., New Delhi, 2013[**497-504**]

6. Why do we need ADC and DAC? Draw the block diagram to interface 8085 microprocessor with ADC and DAC.

ANS: R.S. Gaonkar, 'Microprocessor Architecture Programming and Application', with 8085, Wiley Eastern Ltd., New Delhi, 2013[**404-422**]

7. Draw and explain the functional block diagram of 8237.

ANS: R.S. Gaonkar, 'Microprocessor Architecture Programming and Application', with 8085, Wiley Eastern Ltd., New Delhi, 2013[**514-520**]

8. Draw and explain the functional block diagram of 8255 PPI with 8051

ANS: Muhammad Ali Mazidi & Janice Gilli Mazidi, R.D. Kinney 'The 8051 Micro Controller and Embedded Systems', PHI Pearson Education, 5th Indian reprint, 2003[**390-394**]

9. Draw and explain the functional block diagram of 8279 with 8051.)

ANS: Muhammad Ali Mazidi & Janice Gilli Mazidi, R.D. Kinney 'The 8051 Micro Controller and Embedded Systems', PHI Pearson Education, 5th Indian reprint, 2003[**311-314**]

10. Draw the block diagram to interface 8051 microcontroller with ADC and DAC

ANS: Muhammad Ali Mazidi & Janice Gilli Mazidi, R.D. Kinley 'The 8051 Micro Controller and Embedded Systems', PHI Pearson Education, 5th Indian reprint, 2003 [322-327, 344-348]

UNIT – V: MICRO CONTROLLER PROGRAMMING & APPLICATIONS

1. Write an assembly language program based on 8051 microcontroller instruction set to perform four arithmetic operations on 2, 8 bit data and Explain the data transfer instructions and program control instructions of 8051 microcontroller.

ANS: Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085, 8086, 8051, McGraw Hill Edu, 2013. [767-792]

2. Explain the different operand addressing modes in 8051 microcontroller with examples. **ANS:** Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085, 8086, 8051, McGraw Hill Edu, 2013. [763-767]

3. Explain the interfacing of Keyboard/Display with 8051 microcontroller. and How to interface a 7 segment display using 8051 microcontroller.

ANS: Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085, 8086, 8051, McGraw Hill Edu, 2013. [807-808]

4. Draw the schematic for interfacing a stepper motor with 8051 microcontroller and write 8051 ALP for changing speed and direction of motor. Explain with a program to rotate the stepper motor in both clockwise and anticlockwise direction using 8051 microcontroller.

ANS: Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085, 8086, 8051, McGraw Hill Edu, 2013. [817-820]

5. Explain the servomotor control using 8051 microcontroller.

ANS: Muhammad Ali Mazidi & Janice Gilli Mazidi, R.D. Kinley 'The 8051 Micro Controller and Embedded Systems', PHI Pearson Education, 5th Indian reprint, 2003. [441-444]

6. How 8051 is used in washing machine control.

ANS: R.S. Gaonkar, 'Microprocessor Architecture Programming and Application', with 8085, Wiley Eastern Ltd., New Delhi, 2013 [820-826]