DEPARTMENT OF ELECTRONIC AND COMMUNICATION ENGINEERING
EC6504-MICROPROCESSOR AND MICROCONTROLLER

PART-A

UNIT -I

1. Define 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 instructions, and provides result as output.

2. Explain the function of ALE   in the 8085   architecture?(or) How address   and data lines are demultiplexed?

The ALE signal goes high at the beginning of each machine cycle indicating the availability of the address on the address bus, and the signal is used to latch the low-order address bus(A0-A7) by demultiplexing the address/data bus(AD0-AD7),which are multiplexed.

3.What is the function of HOLD and HLDA?

HOLD- It indicates when another device is requesting the use of address and data bus(like DMA controller). HLDA(Hold Acknowledge)- It indicates that HOLD request has been received. After the removal of HOLD request the HLDA goes low.

4. What is the purpose of READY and TRAP pins in 8085 Microprocessor?

READY- It is used to interface slow speed peripherals with microprocessor. TRAP- Vectored and non-maskable hardware interrupt.

5.List the operations performed by IO/M in 8085.

Memory Read, Memory Write ,I/O Read, I/O Write are the operations performed by IO/M in 8085.

6.Differentiate between Memory mapped I/O and I/O mapped I/O.

S.NO	Memory mapped I/O	I/O mapped I/O
1.	It is treated as memory location	It is not treated as memory location
2.	No special instructions are needed to access the I/O devices	It requires special instructions like IN, OUT to access I/O devices
3.	Microprocessor can access 1 MByte memory locations or I/O ports	Microprocessor can access 64 KByte memory locations or I/O ports
4.	It requires 20 address lines	It requires 16 address lines

5.	MEMR, MEMW signals can be used to access I/O devices	IOR , IOW signals are used
6.	It is suitable for small system	It is suitable for large system

7.If a 6Mhz crystal is connected with 8085, how much is the time taken by 8085 to complete opcode fetch cycle and memory read cycle?

Clock frequency =

crystal frequency / 2 =

6 Mhz/2

=3Mhz One

T-state = 1/

clock freq

=$1/(3X10^6)$

=

0.333µsec

Time for opcode fetch cycle = 4 Xµs

0.33= 1.332 µsec Time for memory

read cycle= 43X 0.33=0.999 µsec

8.Write the operation carried out when 8085 executes DAD r_p instruction and which flag is affected?

DAD- means DOUBLE ADDITION. It is used to perform addition of two 16 bit data.

$[HL]= [HL]+ [r_p]$

The contents of r_p pair is added with the HL content and the result is stored in HL pair register. On execution of this instruction only carry flag (CY) is affected

9.What are the flags available in 8085?

S	Z		AC		P		CY

S- sign flag   Z-Zero flag   AC- Auxiliary carry flag   P-Parity flag   CY- Carry flag

10.Specify the five control signals commonly used by the 8085 MPU.

1. RD-Read signal 2.WR- Write signal 3.READY- Ready signal

4.ALE- Address Latch Enable 5.CLK OUT –Clock Out Signal

11.What is the difference between Opcode and Operand?

Opcode is the part of an instruction that identifies a specific operation.

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

Example: MVI A ,18H

MVI A is Opcode and 18 H is Operand.

12.List some of the logical instructions in 8085.

ANA B, ORA B, XRA B, CMA, STC.

13.What is Stack and Subroutine?

Stack -It is a reserved area of the memory in the RAM , where temporary information may be stored.

Subroutine- It is a group of instructions written from the main program to perform a function that occurs repeatedly in the main program.

14.Why address bus is unidirectional?

It is a 16 bit communication line(A0-A15).It is used to indicate the location of data .

Since the data flows from MPU (microprocessor unit) to Peripheral devices, the address bus is unidirectional.

15.Why data bus is bi-directional?

The microprocessor has to fetch (read) the date from memory or input device for processing and after processing , it has to store (Write) the data to memory or output device. Hence the data bus is bi-directional. i.e. data flow from the MPU (microprocessor unit)to peripherals or peripherals to MPU.

16.What is fetch and execute cycle?

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.

17.What are the difference between PUSH and POP instruction?

S.NO	PUSH	POP
1.	Push register pack onto stack	Pop off stack to register pair
2.	The contents of the register pair designated in the operand are copied into the stack. The SP is decremented and the contents of the high order register are copied into that location.	The contents of memory location pointed out by the SP register are copied into the low order register of the operand.

18.What is an interrupt?

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.

19.What are the different machine cycles available in 8085 microprocessor?

Opcode fetch, Memory Read , Memory write , I/O Read, I/O write , Interrupt acknowledge

cycle , Bus idle cycle.

20.Define (a)Instruction Cycle (b) M/C Cycle (c) T-state

Instruction cycle: Time required to complete the execution of an instruction. One instruction

cycle consists of 3 to6 machine cycles.

Machine cycle: Time required to complete one operation of accessing memory or I/O

device.One machine cycleconsists of 3 to 6 T-states.

T-State: The portion of the operation performed in one clock period.

21.What is the function of SID and SOD pins in 8085?

SID(Serial Input Data) line can be input to the most significant bit of the

accumulator. SOD(Serial Output Data) line can be used to output the

most significant bit of the accumulator.

22.Name the vectored and Non-vectored

interrupts of 8085 system.Non -vectored interrupts

: INTR

Vectored interrupts   : TRAP , RST 7.5 , RST 6.5 , RST 5.5

23. How many machine cycles are needed to execute LHLD and XCHG instructions?

LHLD : 5 machine

cycles (16 T states)

XCHG : 1 machine

cycle (4 T states)

24.What are the types of instruction for 8085 microprocessor?

Data transfer instruction, Arithmetic instruction , Logical and rotate instruction,

branch instruction , stack instruction , I/O and Machine control instruction.

25.What are the addressing modes for 8085 microprocessor?

Immediate addressing mode ,Direct addressing mode, register addressing mode, register

indirect addressing mode, and Implied addressing mode.

26.What is the function performed by SIM and RIM instructions?

SIM (Set Interrupt Mask)- It is a multipurpose instruction and used to implement the

8085 interrupts(RST 7.5, 6.5 ,5.5) and serial data output.

RIM(Read Interrupt Mask)-It is used to read the status of interrupts (RST 7.5 , 6.5 ,

5.5) and to read serial data input bit.

27.What is the significance of XCHG and SPHL instructions?

XCHG : H $\leftrightarrow$ D   Exchanges the contents of H with D and L with E registers.

L $\leftrightarrow$ E

SPHL : SP $\leftarrow$ HL   It copies the contents of HL pair into the stack.

28.Which are the instructions that affect the sequence flow of an 8085 assembly program?

Branch instructions are used to change the sequence of program execution either conditionally or unconditionally. Example : JMP address , J(condition) address, CALL address, CALL (condition) address, RET, RET(condition), RST n.

29.What is a two byte instruction?

In a two byte instruction , first byte specifies the operation code and the second byte
specifies the operand. Example : MVI A, 18 H

MVI A, is OPCODE and 18 H is OPERAND.

**30.Compute the execution time of instruction LDA 2050H if the T state duration is 2 μ
s?**

For LDA, Number of T-state =13

Execution Time is = 13 X2 μ s = 26 μ s .

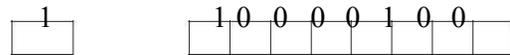**31.What are the classifications of instruction set according to word size?**

One byte instruction , Two byte instruction , and Three byte instruction.

**32.Let accumulator content is 9AH and CY=1. What will be the content of CY
after RRC instruction is executed?**

Before execution

| 1 | | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |

After execution

| 1 | | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
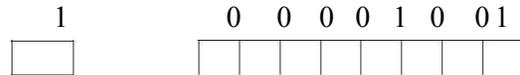
33.What are the Processor control instructions?

Machine control instructions are used to control the operation of processor. EI, DI, NOP,
HLT, SIM, RIM are the Processor control instructions.

34.What is EI and DI instruction?

EI(Enable Interrupt)- When this instruction is executed , the interrupts are Enabled.

DI(Disable Interrupt)- When this instruction is executed , the interrupts are Disabled.

35.What is Immediate and Implied Addressing mode?

In Immediate addressing mode , the data(operand) is specified within the instruction itself.

Example: MVI A, 18 H

In Implied addressing mode, the instruction itself specifies the
meaning with no operands .Example : STC (Set the Carry flag)

36. What are the two compare instructions available in 8085?

1.CMP register (compare reg with accumulator)

Example: CMP B

2.CMP data (compare accumulator with

immediate data) Example: CMP 24H

37. What is an ALU?

The operations performed by ALU of 8085 are Addition, Subtraction, Logical AND,

OR, Exclusive OR, Compare Complement, Increment, Decrement and Left I Right

shift

38. If the 8085 adds 87H and 79H, specify the contents of the
accumulator and the status of the S, Z, and CY flag?

The sum of 87H and 79H =100H. Therefore, the accumulator will have 00H, and the flags

will be S =0, Z = 1, CY = 1.

39. **Write down the control and status signals?**

Two Control signals

and three status signals

Control signals : RD

and WR

Status signals : IO/M, S0, S1

40. 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 . JNZ change the program sequence to the location specified by the 16-bit address

if the zero flag is reset.

41. What is CALL instruction?

CALL instruction change the sequence to the location of a subroutine

42. What is a three-byte instruction?

In a three- byte instruction, the first byte specifies the Opcode, and the following two bytes specifies the 16- bit address.

43. What is an IN instruction and OUT instruction?

IN is a 2-byte instruction. It accepts data from the input port specified in the second byte.

OUT is a 2 -byte instruction. It sends the content of the accumulator to the output port specified in the second byte.

UNIT-II

1.What is pipelining?

Fetching the next instruction while the current instruction executes is called pipelining.

2.What are the signals involved in memory bank selection in 8086 microprocessor?

Entire memory is divided into two memory banks : $bank_0$ and $bank_1$. $Bank_0$ is selected only when A_0 is zero and

$Bank_1$ is selected only when BHE is zero .A_0 is zero for all even addresses. So $bank_0$ is usually referred as *even*

addressed memory bank.BHE is used to access higher order memory bank , referred to as *odd addressed memory* bank.

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

The crystal oscillator in 8284 generates a square wave signal at the same frequency as the crystal . The maximum internal clock frequency of 8086 is 5Mhz

4.What is the use of MN/MX signals in 8086?

It is used to operate the microprocessor in two operating modes i.e. maximum and minimum mode. The minimum mode is used for small systems with a single processor and maximum mode is for medium size to large systems, which include two or more processors.

5.How many data lines and address lines are available in 8086?

Address lines= 20
bit address bus
Data lines= 16 bit
data bus

6.What information is conveyed when Qs1 and Qs0 are 01?
Qs_1 and Qs_0 are output signals that reflect the status of the instruction queue. When Qs1 and Qs0 are 01 , then queue has first byte of an opcode.

7.What is the addressing mode of MOV AX, 55H (BX) (SI) ?
MOV AX, 55H (BX) (SI) – Base Indexed memory addressing mode.

8.What happened in 8086 when DEN =0 and DTR=1 ?
This signal informs the transceivers that the CPU is ready to send data.

9.What is the use of Instruction Queue in 8086 microprocessor?

The queue operates on the principle of first in first out(FIFO). So that the execution unit gets the instruction for execution in the order they fetched .Feature of fetching the next instruction while the current instruction is executing is called pipelining which will reduce the execution time.

10.What are the signals used in 8086 maximum mode operation?
Qs_1 ,Qs_0, s_0 ,s_1, s_2, LOCK, RQ/GT_1, RQ/GT_0 are the signals used in 8086 maximum mode operation.

11.Write the size of physical memory and virtual memory of 8086 microprocessor.

Physical addresses are formed when the left shifted segment base address is added to the offset address. The combination of segment register base addresses and offset address is the logical address in memory.

Size of physical
memory=2^{20}=1MB
Size of virtual
memory=2^{16}=64 KB

12.List the advantages of using segment registers in 8086.

*   It allows the memory addressing capacity to be 1MB even though the address associated with individual

    instruction is only 16-bit.

*   It facilitates use of separate memory areas for program , data and stack.
*   It allows the program to be relocated which is very useful in multiprogramming.

13.What are the segment registers of 8086?
CS- Code segment, DS-Data segment, ES-Extra segment, SS- Stack segment.

14.Explain the BHE and LOCK signals of 8086

BHE (Bus High Enable): Low on this pin during first part of the machine cycle indicates that at least one byteof the current transfer is to be made on higher byte AD15-AD8.

LOCK: This signal indicates that an instruction with a LOCK prefix is being executed and the bus is not to be usedby another processor.

15.Name any four flags of 8086.
Auxiliary carry flag(AF), Carry flag(CF), Direction flag(DF), Interrupt flag(IF),
Overflow flag(OF), Parity flag)PF),
Sign flag(SF), Trap flag(TF), Zero flag(ZF).

16.How the physical address for fetching the next instruction to be executed, is obtained in 8086?

The physical address is obtained Physical address=12345 H by appending four zeros to the content present in CS register and then adding the content of IP register with the above value .

For example, assuming the content of CS = 1200 H

IP = 0345 H

CS= 0001 0010 0000 0000 0000 0000 0011 0100 0101

0001 0010 0011 0100 0101 –

17.If the execution unit generates effective address of 43A2 H and the DS register contains 4000 H. What will be the physical address generated by the BIU? What is the Maximum Size of the data segment?

Effective address
= 43A2 H
Physical address
= 40000H

443A2 H
Maximum size of DS = 2^{16} = 64 KB

UNIT –III

1.Mention the function of SI and DI registers.

SI: Source Index

It is used to hold the index value of source

operand (data) for string instructions. DI:

Destination Index

It is used to hold the index value of destination operand (data) for string

instructions .It is used for single stepping through a program.

2.Name any 8 processor control instructions.

CLC, WAIT, CMC, HLT, STC, LOCK, STD, NOP.

20.What is meant by software interrupt in 8086?

The software interrupts are program instructions. These instructions are inserted at desired

locations in a program. While running a program , if a software interrupt is encountered

then the processor executes an interrupt service routine (ISR).

3.What is the function of TF,DF ,IF in 8086?

TF: It is used for single stepping through a program. In the mode, the 8086 generates

an internal interrupt after execution of each instruction.

DF: It is used to set direction in string operation.

IF: It is used to receive external maskable interrupts through INTR pin. Clearing IF, disable

these interrupts.

22.What is operation carried out when 8086 executes the instruction MOVSB ?

MOVSB – Move String Byte

[[DI]] $\leftarrow$ [[SI]]

Move 8 bit data from memory location addressed by SI segment in DS location to addressed by DI in segment ES.

If DF (Direction Flag) = 0, SI is
incremented by 1. = 1, SI is
decremented by 1.

4.What is the operation carried out When 8086 executes the instruction MOVSW ?

MOVSW – Move String Word.

This instruction transfers a word from the source string (addressed by SI) to the destination string (addressed by DI) and update SI and DI to point to the next string element.

5.What are the difference between 8085 and 8086?

s.no	8085	8086
1	8 bit microprocessor	16 bit microprocessor
2.	16 2 memory locations	10 2 memory locations
3.	Sequential facility	Pipelined architecture available
4.	Low speed	High speed

6.State the functional units available in 8086?

BIU- Bus Interface Unit EU- Execution Unit

UNIT-IV

1. What is the purpose for the 8255 PPI?

The 8255A is a widely used, programmable, parallel I/O device.It can beprogrammed
to transfer data under various conditions, from simple I/O to interrupt I/O.

2. List the operating modes of 8255A PPI?

♦Two 8-bit ports (A and B) ♦Two 4-bit ports (Cuand CL) ♦Data bus buffer

♦Control logic

**3. Specify the bit of a control word for the 8255, which differentiates between theI/O
mode and the BSR mode?**
BSR mode D7= 0, and I/O mode D5 = 1

4. Write the input/output feature in Mode 0 for the 8255A PPI?

Outputs are latched Inputs are not latched

Ports do not have handshake or interrupt capability

5Write down the output control signals used in 8255A PPI?

♦OBFoutput Buffer Full ♦ACKAcknowledge ♦INTR Interrupt request ♦INTE Interrupt
Enable

6. What is the use of mode 2 in 8255A PPI?
This mode is used primarily in applications such as data transfer betweentwo computers or
floppy disk controller interface

7.List the major components of 8279 keyboard /display interface?
♦ Keyboard section ♦Scan section ♦Display section ♦MPU interface9.

8.What is the purpose for scan section in Keyboard interface?

The scan section has a scan counter and four scan lines. These scan linescan be decoded using a 4-to-16 decoder to generate 16 lines for scanning

9.What is USART?

USART is an integrated circuit.It is a programmable device ;itsfunctionand specifications for serial I/O can be determined by writing instructions in itsinternal registers .

10.Define Baud?
The rate at which the bits are transmitted is called Baud
11. Define parallel-to-serial conversion?

In serial transmission, an 8-bit parallel word should be converted in to astream of eight serial bits. This is
known as parallel-to-serial conversion

12.Define serial-to-parallel conversion?

In serial reception, the MPU receives a stream of eight bits and it isconverted in to 8-bit parallel word. This is known as serial -to- parallel conversion.

13. Define simplex transmission?

In simplex transmission, data are transmitted in only one direction.Example: transmission from a microcomputer to a printer.

14. What is transmitter section in USART?

The transmitter section accepts parallel data from the MPU and convertsthem in to serial data. It has two registers. A buffer register and an output register

15. Write an instruction for serial output data?

MVI A, 80H ;Set D7 in the accumulator = 1RAR ;Set D6 = 1SIM

16. List the major components of 8251A programmable communication inteface?

♦Read/Write control logic ♦Three buffer registers ♦Data register

♦Control registertransmission receiver ♦Data bus buffer

♦Modem control

17.Write the steps necessary to initialize a counter in write operations?

♦Write a control word into the control register ♦Load the low-order address byte

♦Load the high order byte

18.Give the various modes of 8254 timer?

Mode 0: interrupt or terminal count Mode 1: Rate generator

Mode 3:square wave generator Mode 4: software triggered strobe Mode 5:hardware triggered strobe

19. What is read back command in 8254 timer?

The Read- Back Command in 8254 allows the user to read the count andthe status of the counter.

UNIT-V

1.What is Microcontroller?

Microcontroller incorporates all the features that are found in microprocessor with the added features of in-built ROM, RAM, Parallel I/O, Serial I/O, counters and clock circuit to make a micro computer system on its own.

2. What are the alternate functions of Port 3 in 8051 microcontroller?

P3.0-RXD

P3.1-TXD

P3.2-INT0

P3.3-INT1

P3.4-T0

P3.5-T1

P3.6-WR

P3.7-RD

3. What is the function of SM2 bit present in SCON register in 8051?

- SM2 enables the multiprocessor communication feature in modes 2 and 3. If SM2 = 1, RI will not be

  activated if the received 9th data bit (RB8) is 0.
- In mode 1, if SM2 = 1, RI will not be activated if a valid stop bit was not received.
- In mode 0, SM2 should be 0.

4. If a 12 Mhz crystal is connected with 8051, how much is the time taken for the count in timer 0 to get incremented by one?

Baud rate = oscillator frequency/12 = $(12 \times 10^6) / 12$

$= 1 \times 10^6$ Hz

T $\quad = 1/f$

$= \quad 1 /(1 \times 10^6)$

$= \quad 1 \ \mu \ \text{sec}$

5. What is the advantage of microcontroller over microprocessor?

- The overall system cost is low , as the peripherals are integrated in a single chip.
- The size is very small

- The system is easy to troubleshoot and maintain.

- If required additional RAM , ROM and I/O ports may be interfaced.

- The system is more reliable.

6.What is the function of IP register in 8051?

The IP register is used to set high priority to one or more interrupts in 8051.

-	-	-	PS	PT1	PX1	PT0	PX0
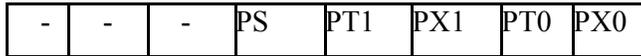
the corresponding interrupt to have high priority and setting a bit to 0

Setting a bit to 1 makes makes the

corresponding interrupt to have low

priority.

7.What is the importance of special function registers(SPF) in 8051?

The 8051 operations that do not use the internal 128 byte RAM address from 00 H to 7F H are done by a group of special internal registers called SPFs(Special Function Registers) Which have address between 80 H and FF H.

8.Define baud rate.

Baud rate is used to indicate the rate at which
data is being transferred . Baud rate = 1/Time
for a bit cell.

9.Name the interrupts of 8051 microcontroller.

External interrupt-0 , External interrupt-1,Timer-0 interrupt, Timer-1 interrupt, and serial port interrupt.

10.Name any 4 additional hardware features available in 8051 when compared to microprocessor.

ROM ,RAM ,Parallel I/O , Serial I/O , Counters, and a clock circuit are available.

11.What is the function of DPTR register?

The data pointer register (DPTR) is the 16 bit address register that can be used to fetch any 8 bit data from the data memory space. When it is not being used for this purpose, it can be used as two eight bit registers , DPH and DPL.

12.What are the features of 8051 microcontroller?
- 8 bit CPU with registers A and B
- 16 bit PC and DPTR
- 8 bit PSW
- Internal ROM of 4KB
- Internal RAM of 128 bytes
- Two 16 bit timers and counters: T0 and T1
- Two external and three internal interrupts
- 32 input / output pins arranged as four 8 bit ports :Port0, port1, port2 and port3.
- Control registers are: TMOD, TCON, SCON ,PCON ,IP and IE.

13.What is the job of the TMOD register?

TMOD (timer mode) register is used to set the various timer operation modes . TMOD is dedicated to the two timers (Timer0 and Timer1) and can be considered to be two duplicate 4 bit registers, each of which controls the action of one of the timers

14.List any applications of microcontroller
- Industrial control (process control)
- Motor speed control(stepper motor control)
- Peripheral devices(printer)
- Stand alone devices(colour Xerox machine)
- Automobile applications(power steering)
- Home applications (washing machine)

15.What are the bits available in TMOD register?

GATE	C/T	M1	M0	GATE	C/T	M1	M0
TIMER 1				TIMER 0			

M1	M0	Mode
0	0	0(13 bit Timer Mode)
0	1	1(16 bit Timer Mode)
1	0	2(8 bit auto reload)
1	1	3(split Timer Mode)

GATE: Gating control when set

C/T : Timer or counter selection ; 1= counter , 0= Timer.

16.What are the timers available in 8051?

- Timer 0
- Timer 1

Each 16 bit timer is accessed as two separate 8 bit registers : Low byte register(TL) and High byte register (TH).

17.Explain the instruction : SWAP

SWAP instruction works only on the accumulator (SWAP A) . It swaps the lower nibble and higher nibble .The lower 4 bits are put into the higher 4 bits and the higher 4 bits are put into the lower 4 bits.

E.g.- SWAP A

ACC

Before | 1111 0000 | **execution** :

After | 0000 1111 | **execution** :

18.What are the external hardware interrupts in 8051?

INT0 - External
hardware interrupt 0
INT1 - External
hardware interrupt 1