PANDIAN SARASWATHI YADAV ENGINEERING COLLEGE

Arasanoor, Sivagangai-630 561.

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

EC6504-MICROPROCESSOR AND MICROCONTROLLER

2 & 16 Mark Questions and Answers

Branch:ECE

Year/Sem:III/V

Prepared by

[A.PONMALAR,
AP/ECE]

HOD/ECE

UNIT-I

Part-A

1. What is Microprocessor?

A microprocessor is a multipurpose programmable electronic device that reads binary instruction from memory, accepts binary data as input and process the data according to those instruction, and provide results as output.

2. What is the difference between Microcontroller and Microprocessor? [Nov/Dec 2014][Nov/Dec 2011]

S.No	Microprocessor	Microcontroller
1.	MP has only CPU.	MC has CPU in addition with a fixed amount of RAM,ROM etc.
2.	MP find applications where task are Unspecific.	MC designed to perform specific tasks.
3.	MP is quite costly.	MC is far cheaper than MP.

3. List the segment registers of 8086.

The segment registers of 8086 are code segment, data segment stack segment and extra segment registers.

4. Compare macro and subroutine

S.No	Macro	Subroutine
1.	It is used to perform specified operations.	Subroutines are also used in specified operations like macros.
2.	In macros only name of macro is used and at the end of each macro ENDM is used	In a subroutine CALL and RET are used

3.	Macros are faster than subroutines	Subroutine are slower than macros
4.	Macros are used for very few instructions,approximately 10 instructions	More than ten instruction are used in a subroutine

5. Write about the different types of interrupts supported in 8086? [Apr/May 2015]
The interrupts of 8086 are INTR and NMI. The INTR is general maskable interrupt and NMI is non-maskable interrupt.

6.What is the difference between the opcode and operand? [Nov/Dec 2004] [Apr/May 2005]
Opcode is a part of instruction that tells a specific operation, whereas an operand is also a part of instruction that represents a value on which the operation is performed.
Ex: MVI A, 99H
Where MVI A represents opcode and 99H represents operand or data.

7. Why is the data bus is bidirectional? [Apr/May 2004]
The microprocessor has to fetch the data from memory or Input device for processing and after processing the data, it has to store the results (data) to memory or output device. Hence the data bus is bidirectional.

8. What is I/O mapped I/O?
This is one of the techniques for interfacing I/O devices with MP. In I/O mapped I/O, the I/O devices assigned and identified by 8-bit addresses. To transfer the data between MPU and I/O devices I/O related instructions (IN and OUT) and I/O control signals (IOR, IOW) are used.

9. Draw the 8086 flag register format. [Apr/May 2010]

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
U	U	U	U	OF	DF	IF	TF	SF	ZF	U	AF	U	PF	U	CF

Carry flag (CF), Parity flag (Pf), auxiliary carry flag (AF), Zero flag (ZF), sign flag (SF), Overflow flag (OF), Trap flag (TF), Interrupt flag (IF), Direction flag (DF)

10. What is the use of PC and SP in 8086?
There are 2 special purpose registers in 8086.
1. Program Counter (PC): It is a 16-bit register and it is used to carry memory address of the next instruction to be executed.
2. Stack Pointer (SP): The stack is a reserved area of memory in the RAM where temporary information may be stored. A 16-bit Stack Pointer is used to hold the address of the most recent stack entry.

11. Define an addressing mode?
The way in which an operand is specified is called an addressing modes.

12. If CL=78H what is the value of CL after the instruction ROL CL, 03.
78=0111 1000 after ROL CL, 03 then 1100 0011, i.e.C3H

13. What are assembler directives? Give an example. [Apr/May 2011][May/June 2012]
Assembler directives or pseudo instructions are to help the programmer to communicate the program requirements to the assembler.
Ex: ORG 200H
If the ORG 200H statement is present at the starting of the code segment of that module, then the code will start from 200H address in code segment.

14. Compare procedure and macro

S.No	Procedure	Macro
1.	Machine code for instruction is put only once in the memory.	Machine code is generated for instructions each time when macro is called.
2.	With procedure less	With macros more memory is

	memory required.	required
3.	Accessed by CALL and RET instruction during program execution	Accessed during assembly with name given to macro when defined
4.	Parameters can be passed in registers,memory.	Parameters passed as part of statement which calls macro.

15. Give the register classification of 8086. [Apr/May 2011]
The 8086 contains:
i. General purpose registers:
They are used for holding data, variables and intermediate results temporarily.
ii. Special purpose registers:
They are used as segment registers, pointers, index register or as offset storage registers for particular addressing modes.

16. How is the physical address calculated? Give an example. [Nov/Dec 2013]
The physical address, which is 20-bits long, is calculated using the segment and offset registers, each 16-bit long. The segment address is shifted left bit-wise four times and offset address is added to this to produce a 20 bit physical address.
Eg: segment address - > 1005H
Offset address - > 5555H
Segment address - > 1005H - > 0001 0000 0000 0101
Shifted by 4 bit position - > 0001 0000 0000 0101 0000
Offset address - > + 0101 0101 0101 0101
Physical address - > 0001 0101 0101 1010 0101
1 5 5 A 5

17. Calculate the physical address, when segment address is 1085H and effective address is 4537H. [Nov/Dec 2015]
Segment address - 1085H
Effective address - 4537H

Physical address - 14D87H

---

18. What is meant by memory segmentation?

Memory segmentation is the process of completely dividing the physically available memory into a number of logical segments. Each segment is 64K byte in size and is addressed by one of the segment register.

19. List the addressing modes of 8086.Give examples.[Apr/May 2015]

Immediate addressing mode- MOV AX,0005H
Register addressing mode- MOV AX,BX
Direct Memory addressing mode- MOV BX,[4500H]
Register Indirect addressing mode- MOV AX,[SI]
String addressing mode- MOVSB,CMPS

20.Show how the 2 byte INT instruction can be applied for debugging.[Nov/Dec 2015]

INT is an assembly language instruction for 8086processor that generates a software interrupt. It takes the interrupt number formatted as a byte value.

INT 'X', where x is software instruction that should be generated (0-255)

21. Write about the different types of interrupts supported in 8086.

(a) Divide by Zero interrupt (Type 0)
(b) Single step interrupt (Type 1)
(c) Non-maskable interrupt (Type 2)
(d) Breakpoint interrupt (Type 3)
(e) Overflow interrupt (Type 4)
(f) Software interrupt (Type 0-255)
(g) Maskable interrupt (INTR)

Part-B

1. Explain the architecture of Intel 8086 with the help of a block diagram. [Apr/May 2015] [Nov/Dec 2015]
    - Draw the architecture
    - Bus interface unit
    - Execution unit

2. Briefly describe about addressing modes of 8086. [Nov/Dec 2015]
    - Immediate addressing mode
    - Direct addressing mode
    - Register indirect addressing mode
    - Register addressing mode
    - Register relative addressing mode
    - Based index addressing mode
    - Relative based indexed addressing
    - Intrasegment direct addressing mode
    - Intrasegment indirect addressing mode
    - Intersegment direct addressing mode
    - Intersegment indirect addressing mode
    -

3. Explain in detail about the interrupts and interrupt service routines of 8086. [Apr/May 2015] [Nov/Dec 2015]
    - External interrupts
      Ex: Keyboard interrupt
    - Internal interrupts
      Type 0 interrupt
      Type 1 interrupt
      Type 2 interrupt

4. Briefly explain the assembler directives of 8086? [Apr/May 2015]
    - DB DW DQ DT
    - ASSUME ENDP END ENDS
    - EVEN EQU EXTRN GROUP
    - LABEL LENGTH LOCAL
    - NAME OFSET ORG
    - PROC PTR SEG
    - SEGMENT SHORT TYPE
    - GLOBAL

5. Discuss the type of instruction set?
    - Data transfer instruction
    - Arithmetic instruction
    - Logical instruction
    - Control instruction
    - Miscellaneous instruction

6. Write a 8086 ALP to convert BCD data to binary data. [Apr/May 2015]
    - Program
    - Input
    - Output
    - Result

7. Explain the memory organization in 8086?
    - Instruction Queue
    - Segment Registers
    - Advantages of memory segmentation

8. Discuss the different registers in 8086 processor?

- Data register
- Segment register
- Pointer and Index register
- Flag register

UNIT-II
Part-A

1. What are the two operating modes of 8086?

   The processor operates in two modes
   - Minimum mode-Single Processor Configuration
   - Maximum mode-Multiprocessor Configuration

2. State the significance of LOCK signal in 8086?

   This output pin indicates that other system bus master will be prevented from gaining the system bus, while the LOCK signal is low. The LOCK signal is activated by the LOCK prefix instruction and remains active until the completion of the next instruction

3. State the function of queue status lines **QS0** AND **QS1** in 8086 microprocessor?

   These lines give information about the status of the code- prefetch queue. These are active during the CLK cycle after which the queue operation is performed. These are encoded as shown in table

QS1	QS0	INDICATION
0	0	No operation
0	1	First byte of opcode from the queue
1	0	Empty queue
1	1	Subsequent byte from the queue

4. What is the function of the BHE signal in 8086?

BHE is output during the first part of machine cycle. LOW signal on BHE pin indicates access to high- order memory bank governed by data bits AD_{15} AD_8; otherwise access is only to the low order memory bank governed by data bits $AD_7 – AD_0$. BHE and A_0 decide the memory bank and type of access.

5. What is the use of MN/MX Pin in 8086.

The logical level at this pin decides whether the processor is to operate in either minimum or maximum mode.

6. Give the functions of READY and TEST pins of 8086.

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 bus cycles.

TEST is used in conjunction with WAIT instruction. The instruction puts the 8086 in idle states which end only when the TEST input goes low.

7. Mention the use of HOLD and HLDA pin 8086

HOLD request. This signal, when low, indicates that another master has requested for direct memory access. When HOLD becomes low, it indicates that direct memory access is no more required.

HLDA: the microprocessor sends high signal on HLDA to indicate acknowledgement of DMA request. It then tristate the buses and control signals. When HOLD becomes low, the microprocessor makes HLDA low

and regains the control of buses.

8. What are the three groups of signals in 8086?

The 8086 signals are categorized in three groups.

They are:

i. The signals having common functions in minimum and maximum mode.

ii. The signals having special functions for minimum mode.

iii. The signal having special functions for maximum mode.

9. List the Bus allocation schemes?

- Daisy chaining
- Polling method
- Independent method

10. What are the advantages of the multiprocessor system? [May/June 2007]

* High level performance can be attained when parallel processing.
* Robustness can be improved by isolating system functions.

11. Explain why the processor utilization rate can be improved in a multiprocessor system by an instruction queue? [May/June 2008]

The processor has to fetch the instruction from memory before decode and execute it. Fetching the instruction from memory takes considerable amount of time and processor has to wait and processor has to wait during this time, reducing its utilization rate. The instruction queue mechanism before the execution so that processor need not have to wait for instruction fetch,improving the utilization rate.

12. What are the multiprocessor configuration methods?

- Co processor
- Loosely coupled
- Closely coupled

13. Write a program to add a data byte located at offset 0500H in 2000H segment to another data byte available at 0600H in the same segment and store the result at 0700H in the same segment.

```
MOV AX, 2000H; initialize DS with value
MOVDS, AX; 2000H
MOV AX, [500H]; Get first data byte from 0500H offset
ADD AX, [600H]; Add this to the second byte from 0600H
MOV [700H], AX; store AX in 0700H
HLT; Stop.
```

14. Distinguish between the maximum and minimum mode of operation of the 8086 processor. [Nov/Dec 2009]

S.No	Minimum mode	Maximum mode
1.	Simple Processor	Multiple Processor
2.	Used for simple applications	Used for more applications

15. Compare closely coupled configuration with loosely coupled configuration. [Apr/May 2010]

S.No	Closely coupled configuration	Loosely coupled configuration
1.	Shared memory multiprocessor system	Distributed memory multiprocessor system
2.	Several processor share a common memory	Each processor has its own local memory
3.	Well suited and more efficient for higher degree of interaction tasks	More efficient when the interaction between tasks are minimal

16. What is DMA? What are the advantages of DMA?

The direct data transfer between I/O device and memory is called DMA.

Using DMA,bulk data transfer can take place between the memory and I/O device bypassing the microprocessor.

17. What is Multiprogramming? [NOV/DEC 2015]

If more than one process is carried out at the same time,it is known as Multiprogramming.

To improve the utilization of CPU and I/O devices we are designing to process a set of independent programs concurrently by single CPU. This technique is known as Multiprogramming.

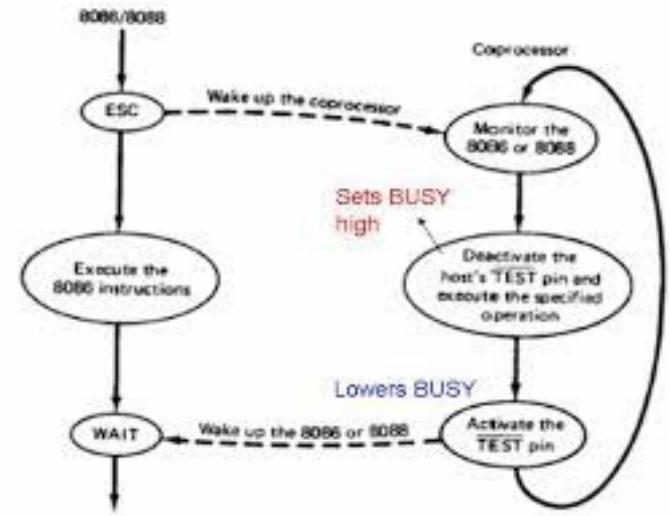
18. Define bus. Why bus request and cycle stealing are required? [APR/MAY 2015]

A set of wires used for transferring information between the components in a computer system is called a Bus.

Bus request are needed to provide connection between various device. In 8086 MP, it receives bus request through its HOLD pin and issues grants from the HLDA pin.

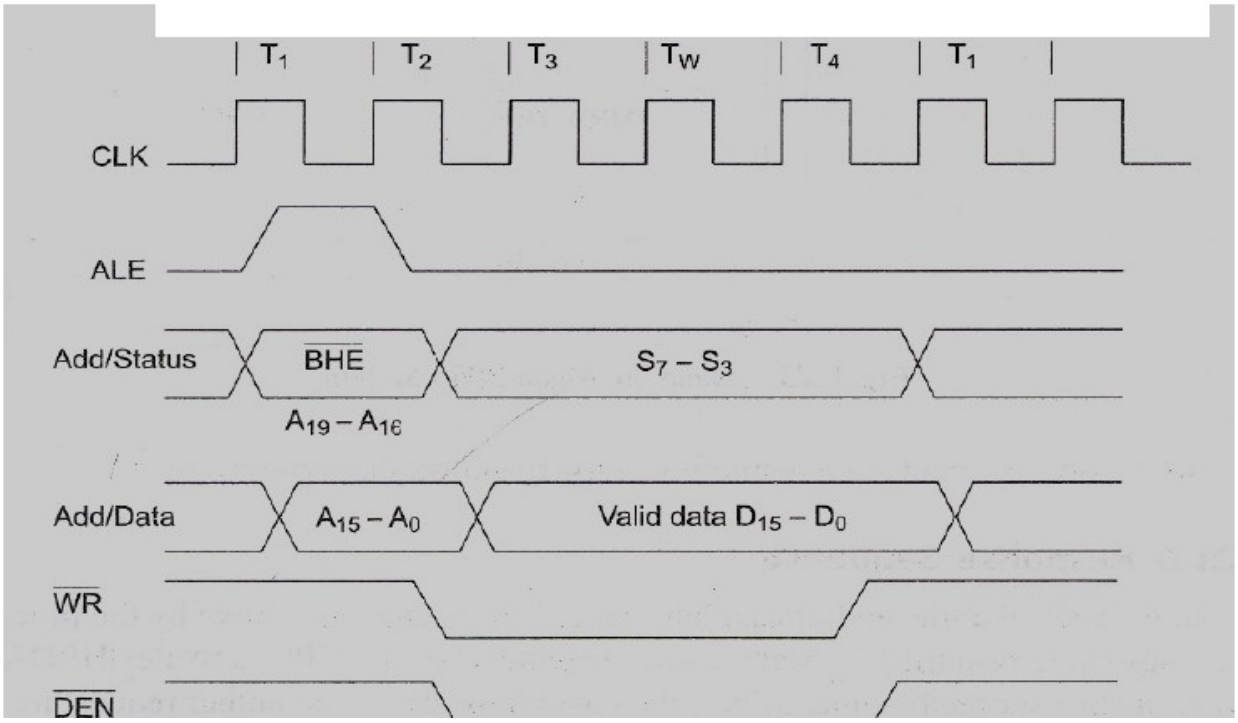
Cycle stealing is required to access RAM without interfacing the CPU.

19. Schematically show,how synchronization is made between 8086 and its coprocessor. [NOV/DEC 2015]



20. Draw the read cycle timing diagram for minimum mode.

Fig.1.2. Read Cycle Timing Diagram for Minimum Mode



Part – B

1. With neat diagram explain the Minimum mode of operation of 8086. [NOV/DEC'15]
    - Block diagram
    - Minimum mode signals
    - Draw the Read and Write bus cycles
    - Explain the T states

2. Discuss the maximum mode configuration of 8086with a neat diagram. Mention the functions of various signals. [APR/MAY'15]
    - Block diagram
    - Minimum mode signals
    - Draw the Read and Write bus cycles

      Explain the T states
3. Explain in detail about Closely Coupled Configuration. Mention the Advantages and Disadvantages of the same.
    - Block diagram
    - Shared memory
4. Define loosely coupled system. Explain the schemes used for establishing priority.[NOV/DEC'15]
    - Definition & Advantages
    - Bus Allocation Schemes
        - Daisy chaining
        - Polling
        - Independent Re-question
5. Discuss the principle and operations of co-Processor Configuration.

- Block diagram
- Interaction between Co-Processor and CPU

6. Explain in detail about the different inter connection topologies in multiprocessor systems.
   - Coprocessor (8087)
   - Closely coupled (8089)
   - Loosely coupled (Multi bus)

7. Explain in detail about the system bus timing of 8086.
   - Minimum mode
   - Maximum mode

8. Explain advanced processors of 8086.
   - Intel 80386
   - Pentium

9. Draw the pin diagram of 8086 CPU with its control signal?
   - Pin configuration
   - Pin description
   - Explain control signals

10. Compare closely coupled configuration with loosely coupled configuration. [APR/MAY'15]
    - Definition
    - Advantages
    - Various schemes

UNIT-III

Part -A

1. Define PPI? [Nov/Dec2004]

PPI is a programmable peripheral interface (IC 8255). It is a programmable parallel IO device that can be programmed to transfer data between microprocessor and the IO devices. It has three ports port A, B and C can be programmed to operate in different modes.

2. What are the differences between serial synchronous data transfer and asynchronous data transfer?

Synchronous Data Transfer:

*Both the transmitter & receiver operates with the same clock synchronously High speed data transfer

*Block of characters transmitted at a time

*Synchronous characters are sent with each group of data

Asynchronous Data Transfer:

*Transmitter and the receiver need not have the same clock

*Low speed data transfer

*One character at a time

*Start and stop bits are to be added to each character

3. What are USART? [Nov/Dec 2004]

Universal Synchronous Asynchronous Receiver Transmitter. It is a programmable device used to convert parallel data in to serial form and vice versa. This IC is used to interface a microprocessor to a modem through RS232C standard serial interface.

4. Differentiate between half duplex and full duplex transmission? [Apr/May 2005]

In duplex transmission data flow in both directions. If the transmission goes one way at a time it is called half duplex. If the transmission goes in both the ways simultaneously it is called full duplex.

5. What are the different types of serial communication? [Nov/Dec 2003]

*Synchronous serial data transmission

*Asynchronous serial data transmission

6. What are the functions performed by 8251? [Apr/May 2005]

It converts parallel data in to serial data and vice versa Data transmission can be either synchronous or asynchronous.

It is used to interface MODEM and establish serial communication through MODEM over telephone lines

7. How many registers are there in 8259?

4 registers are

* Interrupt Request Register (IRR),

*Priority Resolver (PR),

*Interrupt Service Register (ISR),

*Interrupt Mask Register (IMR).

8. Give the various modes and applications of 8254 timer. [Apr/May 2015]

There are 6 modes.

1. Mode 0 :Interrupt on Terminal Count[TC]
2. Mode 1 : Programmable One Shot
3. Mode 2 : Rate Generator
4. Mode 3 : Square Wave Generator
5. Mode 4 : Software Triggered Strobe
6. Mode 5 : Hardware Triggered Strobe

Applications:

- Real time clock
- Event counter
- Programmable rate generator

- Square ware generator
- Complex waveform generator

9. What are the functions performed by 8279? [Apr/May 2005]

*Key board scanning
*Key code generation
*Informing the key depression to CPU
*Storing the display codes
*Display refreshing
*Output display code's to LED's

10. Draw the block diagram of alarm controller with 8086 as processor. [APR/MAY'15]

Refer Page No.3.124

11. What freq. transmit clock (Txc') is required by an 8251 in order for it to transmit data at 4800 baud with a baud rate factor of 16. [Nov/Dec 2015]

Clock frequency = Baud rate/Factor = 4800/16=300Hz.

12. 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 device like memories, latches, ports, etc., to form a microprocessor system.

13. What are the ports in 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.

14. What is key debouncing.

When the key is depressed and released, the contact is not broken permanently. In fact, the key makes and breaks the contacts several times for a few milliseconds before the contact is broken permanently.

15. List the operating modes of 8255A and 8237A. [Nov/Dec 2015]

8255 has 2 modes.

1. I/O mode-Multiprocessor
   - Mode 0
   - Mode 1
   - Mode 2
2. Bit Set-Reset mode (BSR)

8237 has several modes. They are,

- Single mode
- Burst mode
- Block mode
- Demand mode
- Cascade mode

16. What is scanning in keyboard and what is scan time?

The process of sendinga zero to each row of a keyboard matrix and reading the columns for key actuation is called scanning. The scan time is thetime taken by the processor to scan all the rows one by one starting from row and coming back to the first row again.

17. What are the serial transmission modes?

* Simplex
* Duplex
* Half duplex

18. What are the control words of 8251?

- mode instruction control word
- command instruction control word

19. How the microprocessor is synchronized with peripherals?

The timing and control unit synchronizes all the microprocessor operations with clock and generates control signals necessary for communication between the microprocessor and peripherals.

20. What are the priority schemes in DMA controller?

- Fixed priority
- Rotating priority

21. What are the advantages and disadvantages of multiplexed LED display?

Advantages:

- Need only one 7447
- Brightness of LED can be improved by allowing 40 and 60 mA of current to flow per segment. Because only one digit is lit at a time

Disadvantage:

- Software multiplexing approach puts an additional burden on the CPU. It can be avoided by using dedicated controller 8279

Part- B

1) [i] In how many modes we can use 8253/54 timer? Explain the different modes of operation of 8253/54 timer. [8]

- 3 Counters
- 6 Modes

[ii] How to interface a DMA controller with a microprocessor? Explain how DMA controller transfers large amount of data from one memory locations to another memory locations? [8] [NOV/DEC 2014]

- Internal Architecture
- Master mode
- Slave mode

2) [i] Draw the block diagram of a keyboard display controller and explain. [8] [MAY/JUNE 2012]

- I/O control and data buffer
- Control and timing Register and timing control
- Scan counter Return buffers and keyboard debounce and control
- FIFO/ Sensor RAM and status Logic
- Display address registers and display RAM

[ii] Explain in detail about the parallel communication interface. [8] [NOV/DEC 2014]

- Advantage
- Disadvantage
- Block diagram
  - Output only
  - Input and Output

3) [i] Explain the mode 0 operation of 8255 Programmable Peripheral Interface. [8]

Simple I/O

- I/O mode
- BSR mode

[ii] Explain the different modes of operation of a timer. [8] [MAY/JUN 2014]

- Mode 0 Mode 1
- Mode 2 Mode 3
- Mode 4 Mode 5

4) Explain the internal architecture of 8237 Direct Memory Access Controller. [16] [MAY/JUN 2014] [APR/MAY'15]

Ref. Q.No.2

5) Explain the operation of USART chips in microprocessor based systems.[16] [NOV/DEC 2013] [NOV/DEC'15]

- Need for PCI
- Operating modes
    - Synchronous- Transmission & Receive
    - Asynchronous- Transmission & Receive

6) Draw the architectural block diagram of 8259 Programmable Interrupt controller and explain. [16] [MAY/JUN 2012] [NOV/DEC'15]
- Block diagram
- Pin diagram
- Operating modes

7) Explain how to interface LED and LCD displays with 8086 Microprocessor.
- Seven segment display
- Circuit for interfacing

8) Explain keyboard display controller and write an assembly language program to interface a keyboard and the display using 8086 microprocessor.
- Internal architecture
- Modes of operation
- Program

9) With a simple program, explain how you will interface alarm controller with 8086 microprocessor.
- Circuit diagram
- Control word
- Program-delay routine

10) Explain the Traffic light controller and write a program in 8086 processor to interface traffic light controller and processor. [APR/MAY'15]
- Interface diagram
- Road structure

- Flowchart
- Program

11) Explain how D/A and A/D interfacing done with 8086 with an application.
    - Black diagram
    - Performance prameters
    - Characteristics

UNIT IV

Part-A

1. What is Micro controller?

Micro controller 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 micro controller?

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 X 106) / 12
= 1 X 106 Hz
T = 1/f
= 1 / (1 X 106)
= 1 μ sec

5. What is the advantage of Microcontroller over Microprocessor? [APR/MAY'11]

* 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 importance of special function registers (SFR) in 8051? [NOV/DEC'14]

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.

7. Name the interrupts of 8051 microcontroller.

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

8. 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.

9. 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.

10. Mention the number of register banks and their addresses in 8051? [NOV/DEC'15]

There are 4 register banks. They are Bank0, Bank1, Bank2 & Bank3.
RAM locations from 00 to 07H for bank 0
RAM locations from 08 to 0FH for bank 1
RAM locations from 10 to 17H for bank 2
RAM locations from 18 to 1FH for bank 3

11. 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

12. List any applications of microcontroller
*Industrial control (process control)
* Motor speed control(stepper motor control)
* Peripheral devices (printer)
*Standalone devices(color Xerox machine)
* Automobile applications (power steering)
* Home applications (washing machine)

13. 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).

14. 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

	Before execution :	1111 0000
.	After execution :	0000 1111

15. What is the jump range? [NOV/DEC'15]

AJMP addr11 (Absolute Jump) – Within 2K bytes of program memory.
LJMP addr16 (Long Jump) -Within 64K bytes of program memory.
SJMP Rel addr (Short Jump) –128 to +127 of program memory.

16. What is stack pointer (SP)?

* Stack pointer (SP) is a 8 bit wide register and is incremented before the data is stored into the stack using PUSH or CALL instructions.
* It contains 8-bit stack top address. It is defined anywhere in the on-chip 128-byte RAM.
* After reset, the SP register is initialized to 07.

* After each write to stack operation, the 8-bit contents of the operand are stored onto the stack, after incrementing the SP register by one.
* It is not a top-down data structure. It is allotted an address in the special function register bank.

17. What is a serial data buffer?

* Serial data buffer is a special function register and it initiates serial transmission when byte is written to it and if read, it reads received serial data.
* It contains two independent registers internally.
* One of them is a transmit buffer, which is a parallel-in serial-out register. The other is a receive buffer, which is a serial-in parallel-out register.

18. What are timer registers?

Timer registers are two 16-bit registers and can be accessed as their lower and upper bytes. TLO represents the lower byte of the timing register 0, while THO represents higher bytes of the timing register 0. Similarly, TLI and THI represent lower and higher bytes of timing register 1. These registers can be accessed using the four addresses allotted to them, which lie in the special function registers address range, i.e., 801 H to FF.

19. Explain the two power saving mode of operation. [MAY/JUNE'13]

The two power saving modes of operation are:

I. Idle mode:

In this mode, the oscillator continues to run and the interrupt, serial port and timer blocks are active, but the clock to the CPU is disabled. The CPU status is preserved. This mode can be terminated with a hardware interrupt or hardware reset signal. After this, the CPU resumes program execution from where it left off.

II. Power down mode:

In this mode, the on-chip oscillator is stopped. All the functions of the controller are held maintaining the contents of RAM. The only way to

terminate this mode is hardware reset. The reset redefines all the SFRs but the RAM contents are left unchanged.

20. Give the addressing modes of 8051? [NOV/DEC'10]

There are six addressing modes in 8051.They are

* Direct addressing
* Indirect addressing
* Register instruction
* Register specific(register implicit)
* Immediate mode
* Indexed addressing

21. Draw the diagram for Processor Status Word in 8051. [APR/MAY'15]

D7 D0

CY	AC	F0	RS1	RS0	OV	-	P

CY- Carry Flag
AC- Auxillary Carry Flag
F0- General purpose Flag
OV- Overflow Flag
P-Parity Flag
RS1,RS0- Register Bank select

22. Mov r4, r7 is invalid. Why?

The movement of data between the accumulator and Rn (for n = 0 to 7) is valid. But movement of data between Rn register is not allowed. That is why MOV R4, R7 is invalid.

23. How do you select the register bank in 8051 micro controller? [APR/MAY'15]

As stated above, register bank 0 is the default when the 8051 is powered up. We can switch to other banks by use of the PSW (program status word) register. Bits D4 and D3 of the PSW are used to select the desired register bank as

Table 2-2: PSW Bits Bank Selection

	RS1 (PSW.4)	RS0 (PSW.3)	
Bank 0	0	0	00H-07H
Bank 1	0	1	08H-0FH
Bank 2	1	0	10H-17H
Bank 3	1	1	18H-1FH

24. What is the significance of EA line of 8051 microcontroller? [MAY/JUNE'14]

If EA is low, the processor will access 64K from external memory.

If EA is high, the processor will access 4K internal ROM.

Part-B

1. Explain the architecture of 8051 with its diagram. [NOV/DEC'10] [APR/MAY'15]
   - Draw architecture diagram
   - Explain each block

2. Explain the I/O pins ports and circuit details of 8051 with its diagram. [MAY/JUNE'13]
   - Draw the Pin-out of 8051
   - I/O pins
   - Ports-0,1,2,3

3. With example explain the arithmetic and control instruction of 8051

microcontroller. [APR/MAY'15]

Ref Q.No 4

4. With example explain the different instruction set of 8051 microcontroller.
   - Data transfer instruction
   - Arithmetic instruction
   - Logical instruction
   - Control instruction
   - Miscellaneous instruction

5. Explain the different addressing modes of 8051.[NOV/DEC'15]
   - Immediate addressing mode
   - Direct addressing mode
   - Register addressing mode
   - Based Index addressing mode

6. Explain about the register banks and special function register of 8051 in detail. [NOV/DEC'15]
   - EPROM, RAM & ROM address register
   - SFR register
   - Timer registers
   - Control registers

7. Give PSW of 8051 and describe the use of each bit in PSW. [NOV/DEC'15]
   - Format
   - Register Bank

8. Describe the functions of the following signals in 8051. RST,EA,PSEN and ALE. [NOV/DEC'15]

- RST- Reset
- EA-External Access Enable
- PSEN- Program Strobe Enable
- Address Latch Enable

9. Explain the TMOD function register and its timer modes of operations. [APR/MAY'15]

- Format
- Operating Modes

UNIT -V
Part-A

1. 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.

2. What are the rules followed for interfacing i/o pin to external devices?

The few rules that have to be followed are:
i. Only use negatively active signals
ii. If a pin is not actively outputting a signal, set it high.

3. When are timer overflow bits set and reset?

The timer overflow bits are set when timer rolls over and reset either by the execution of an ret instruction or by software, manually clearing the bits. The bits are located in the TCON register along with timer run control (TRn) bits.

4. Explain the mode (0 and1) operation of the timer.

The operations are as follows:

• Timer mode 0 and 1 operations are similar for the 13 bit (mode) or 16 bit (mode 1) counter. When the timer reaches the limits of the count, the overflow flag is set and the counter is reset back to zero.
• The modes 0 and 1 can be used to time external events.
• They can be used as specific time delays by loading them with an initial value before allowing them to execute and overflow.

5. What are the different modes in which timer 2 can operate?

The two different modes in which Timer 2 operates are.

i. Capture mode

Timer 2 operates as free running clocks, which saves the timers value on each high to low transition. It can be used for recording bit lengths when receiving Manchester-encoded data.

ii. Auto-reload mode:

When the timer overflows, value is written into TH2/TL2 registers from RCA P2H/RCA P21 registers. This feature is used to implement a system watch dog timer.

6. What is the use of a watch dog timer?

A watching timer is used to protect an application in case the controlling microcontroller begins to run amok and execute randomly rather than the preprogrammed instructions written for the application.

7. Give the format of the interrupt enable register.

The format of the interrupt enable register is,

EA - - ES ET1 EX1 ET0 EX0

The register is used to enable or disable all 8051 interrupts and to selectively enable or disable each of the five different interrupts.

EA: Disables all interrupts

Es: Enables or disable the serial port interrupt.

ET1: Enable or disable the timer 1 overflow interrupt.

EX1: Enable or disable external interrupt 1.

ET0: Enable or disable the timer 0 overflow interrupt.
EX0: Enable or disable external interrupt 0.

8. What is meant by nesting of interrupts?

Nesting of interrupts means that interrupts are re-enabled inside an interrupt handler. If another interrupt request codes in, while the first interrupt handler is executing, processor execution will acknowledge the new interrupt and jump to its vector.

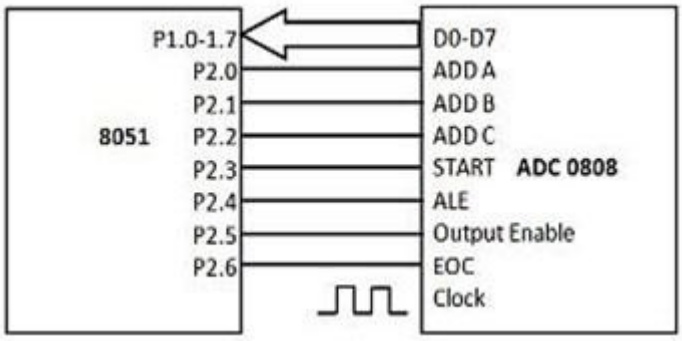
9. How is the 8051 serial port different from other micro controllers?

The 8051 serial port is a very complex peripheral and able to send data synchronously and asynchronously in a variety of different transmission modes.

10. Explain synchronous data transmission.

- In synchronous mode (mode 0), the instruction clock is used.
- Data transfer is initiated by writing to the serial data port address.
- Txd pin is used for clock output, while Rxd pin is for data transfer.
- When a character is received, the status of the data transfer is monitored by polling the RI-n bit in serial control register (SCON).

11. How is A/D converter interfaced with 8051? [NOV/DEC'15]



12. Differentiate between timers and counters. Draw the diagram of TCON in

8051. [APR/MAY'15]

• A counter is a device that records the number of occurrences of a particular event. In modern applications, counters are based on electronic devices and the counters are sequential logic circuit designed to record the number of electric pulses fed into the counter.

• A timer is an application of the counters where a certain signal with a fixed frequency (hence period) is counted to record the time.

D7 D0

TF1	TR1	TF0	TR0	IE1	IT1	IE0	IT0

Where TF1- Timer1 Overflow Flag
TR1- Timer1 Run control bit
TF0- Timer0 Overflow flag
TR0- Timer0 Run control bit
IE1- Interrupt1 Edge flag
IT1- Interrupt1 type control bit
IE0- Interrupt0 edge flag
IT0- Interrupt0 type control bit

13. Differentiate between edge –sensitive and level-sensitive programming of interrupts.

S.No	Edge – sensitive	Level – sensitive
1.	When the interrupts are programmed as edge-sensitive the flags are automatically cleared after the control is transferred to the respective vector.	When the interrupts are programmed as level-sensitive, the flags are controlled by the external internal interrupt sources themselves.
2.	The interrupts should remain	The interrupts should remain high

	high for at least one machine cycle and low for atleast one machine cycle, for being sensed.	for at least two machine cycles for being sensed.

14. Explain the interrupts of 8051 microcontroller?

The interrupts are:

External interrupt 0: IE0: 0003H

Timers interrupt 0 : TF0 : 000BH

External interrupt 1 : IE1 : 0013H

Timer interrupts 1 : TF1 : 001BH

Serial interrupt:

Receive interrupt : R1 : 0023H

Transmit interrupt : T1 : 0023H

15. What are the pins in 8051 used for serial communication?

i) RXD

ii) TXD

16. What is the use of SBUF register?

SBUF is an 8- bit register for serial communication in the 8051. For a byte of data to be transferred via the T_{XD} line, it must be placed in the SBUF register. Similarly, SBUF holds the byte of data when it is received by the 8051's R_{XD} line. SBUF can be accessed like any other register in the 8051.

17. Write the importance of TI flag

The following sequence of steps that the 8051goes through in the transmitting a character via $T_{xD.}$

i. The byte character to be transmitted is written into the SBUF register

ii. It transfers the start bit

18. What are the methods to double the baud rate?
    i. to use a higher frequency crystal.
    ii. to change a bit in the PCON register, shown below

D7							D0
SMOD	-------	------	-------	GF1	GF0	PD	IDL

19. Mention any two applications that used ADC and DAC
    i. Temperature controller
    ii. Stepper motor

20. Mention the features of serial port in mode 0. [NOV/DEC'15]
    In this mode serial enters and exits through RXD, TXD outputs the shift clock. 8 bits are transmitted /received 8 data bits first (LSB first).The baud rate is fixed at 1/12 the oscillator frequency.

21. Which register is used for serial programming in 8051 microcontroller? Illustrate it. [APR/MAY'15]
    SBUF Register (Serial Buffer):
    SBUF is an 8-bit register for serial communication in 8051.For a byte of data to be transferred via TxD line and holds the byte of data when it is received by 8051's RxD line.
    SCON Register (Serial Control):
    SCON is an 8 bit register used to program the start bit,stop bit and data bits of data framing among other things.

SM0	SM1	SM2	REN	TB8	RB8	T1	R1

22. Which register is used for special programming in 8051? Illustrate it. [APR/MAY'15]
    SBUF is an 8bit register dedicated for serial programming in 8051.Its address is 99H.

It can be addressed like any other register in 8051. Writing to SBUF loads data to be transmitted and reading SBUF accesses received data.

There are two distinct registers

(i) The transmit write-only register

(ii) The receive read-only register

Part- B

1 Explain with a neat sketch how microcontrollers and microprocessors can be used for the stepper motor control application. [MAY/JUNE'13]

- Introduction
- Stator & Stepper motor windings
- Stepper motor interfacing

2. Explain about the Timers of 8051 with its Modes of Operation. Also explain about the Registers of 8051 Timers. [APR/MAY'15]
    - Mode 1 Programming
    - Mode 2 Programming
    - Register for timer 0
    - Register for timer 1
    - Control Register- TMOD, TCON
3. What are the interrupts available in 8051? Explain about the Interrupt Structure.
    - Six interrupts
    - External hardware interrupt
    - Serial communication Interrupt
    - Interrupt priority
4. Explain about the Serial data communication of 8051 with its registers. Also

explain about the Modes of operation of the same.

- Introduction
- Program for transfer & receive data serially
- Mode 0 & mode 1

5. Explain about LCD interfacing with its pin details. [APR/MAY'15]
   - Introduction
   - Pin details
   - LCD interfacing

6. Explain in detail about Keyboard interfacing with 8051. [MAY/JUNE'13] [NOV/DEC'15]
   - Introduction
   - Keyboard connection to ports
   - Flowchart
   - Program

7. Discuss about ADC & DAC interfacing with 8051. Also illustrate the chip details of ADC.
   - Introduction
   - Pin details
   - Program

8. Explain about sensor interfacing with 8051.
   - Introduction
   - Signal conditioning
   - Connection to temperature sensor

9. How do you interface External Memory to 8051 Microcontroller? Explain.

- Semi conductor memory interfacing
- Interfacing with external ROM & RAM

10. Explain about interfacing of waveform generator with 8051 Microcontroller.
    - Introduction
    - Program
    - Waveform

11. Draw the schematic for interfacingf a stepper motor with 8051 microcontroller and write 8051 ALP for keypad scanning. [NOV/DEC'15] [APR/MAY'15]
    - Introduction
    - Interface Diagram
    - Program