

EC8691 - MPMC

Question Bank

Part-A

UNIT I- THE 8086 MICROPROCESSOR

1. What is microprocessor?

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

2. What is Accumulator?

The Accumulator is an 8-bit register that is part of the arithmetic/logic unit (ALU). This register is used to store 8-bit data and to perform arithmetic and logical operations. The result of an operation is stored in the accumulator. The accumulator is also identified as register A.

3. What is stack?

The stack is a group of memory locations in the R/W memory that is used for temporary storage of binary information during the execution of a program

4. What is a subroutine program?

A subroutine is a group of instructions written separately from the main program to perform a function that occurs repeatedly in the main program. Thus subroutines avoid the repetition of same set of instructions in the main program.

5. Define addressing mode.

Addressing mode is used to specify the way in which the address of the operand is specified within the instruction.

6. Define instruction cycle.

It is defined as the time required to complete the execution of an instruction.

7. 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.
```

8. What are the different types of addressing modes of 8086 instruction set?

The different addressing modes are:

- i. Immediate
- ii. Direct
- iii. Register
- iv. Register indirect
- v. Indexed
- vi. Register relative
- vii. Based indexed
- viii. Relative based indexed

9. What are the different types of instructions in 8086 microprocessor?

The different types of instructions in 8086 microprocessor are:

- i. Data copy / transfer instructions
- ii. Arithmetic and logical instructions
- iii. Branch instructions
- iv. Loop instruction
- v. Machine control instruction
- vi. Flag manipulation instruction
- vii. Shift and rotate instruction
- viii. String instruction

10. What is assembly level programming?

A program called assembler is used to convert the mnemonics of instruction and data into their equivalent object code modules. The object code modules are further converted into executable code using linker and loader programs. This type of programming is called assembly level programming.

11. What is a stack?

Stack is a top-down data structure, whose elements are accessed using a pointer that is implemented using the SS and SP registers. It is a LIFO data segment.

12. How is the stack top address calculated?

The stack top address is calculated using the contents of the SS and SP register. The contents of stack segment (SS) register is shifted left by four bit positions (multiplied by (0h)) and the resulted 20-bit content is added with the 16-bit offset value of the stack pointer (SP) register.

SS	-	5000H				
SP	-	2050H				
		SS	-	0101	0000	0000 0000
		10H * SS	-	0101	0000	0000 0000 0000
		SP	-	0010	0000	0101 0000
		Stack- top		0101	0010	0000 0101 0000
		Address		5	2	0 5 0

13. What are macros?

Macros are small routines that are used to replace strings in the program. They can have parameters passed to them, which enhances the functionality of the micro itself.

14. how are constants declared?

Constants are declared in the same way as variables, using the format:

Const – Label EQU 012h

When the constants label is encountered, the constant numeric value is exchanged for the string.

15. Write an assembly language program for a 16-bit increment and will not affect the contents of the accumulator.

MACRO inc16 variable; Increment two bytes starting at “variable”

Local INC16 End

INC variable; Increment the low 8 bits

PUSH ACC

MOV A variable; Are the incremented low 8 bits = 0?

JNZ INC 16 End

INC variable + 1

Inc16 End; Yes – increment the upper 8 bits

POP ACC

END MAC

16. What will happen if a label within a macro is not declared local?

If a label within a macro is not declared local, then at assembly time, there will be two types of errors:

I. The first will state that there are multiple labels in the source.

II. The second will indicate that jump instructions don't know which one to use.

17. Write an assembly language program to load the accumulator with a constant value.

MACRO invert value

if (value==0)

MOV A, #1

else

clr A

end if

END MAC.

18. What is the difference between the microprocessor and microcontroller?

Microprocessor does not contain RAM, ROM and I/O ports on the chip. But a microcontroller contains RAM, ROM and I/O ports and a timer all on a single chip.

19. What is assembler?

The assembler translates the assembly language program text which is given as input to the assembler to their binary equivalents known as object code. The time required to translate the assembly code to object code is called access time. The assembler checks for syntax errors & displays them before giving the object code.

20. What is loader?

The loader copies the program into the computer's main memory at load time and begins the program execution at execution time.

21. What is linker?

A linker is a program used to join together several object files into one large object file. For large programs it is more efficient to divide the large program modules into smaller modules. Each module is individually written, tested & debugged. When all the modules work they are linked together to form a large functioning program.

22 .Explain ALIGN & ASSUME.

The ALIGN directive forces the assembler to align the next segment at an address divisible by specified divisor. The format is ALIGN number where number can be 2, 4, 8 or 16. Example ALIGN 8.

The ASSUME directive assigns a logical segment to a physical segment at any given time. It tells the assembler what address will be in the segment registers at execution time. Example ASSUME CS: code, DS: data, SS: stack

23. Explain PTR & GROUP

A program may contain several segments of the same type. The GROUP directive collects them under a single name so they can reside in a single segment, usually a data segment. The format is Name GROUP Seg-name,.....Seg-name

PTR is used to assign a specific type to a variable or a label. It is also used to override the declared type of a variable.

24. Explain about MODEL

This directive provides short cuts in defining segments. It initializes memory model before defining any segment. The memory model can be SMALL, MEDIUM, COMPACT or LARGE.

Model	Code segments	Data segments
Small	One	One
Medium	Multiple	One
Compact	One	Multiple
Large	Multiple	Multiple

25 Explain PROC & ENDP

PROC directive defines the procedures in the program. The procedure name must be unique. After PROC the term NEAR or FAR are used to specify the type of procedure. Example FACT PROC FAR. ENDP is used along with PROC and defines the end of the procedure.

26. Explain SEGMENT & ENDS

An assembly program in .EXE format consists of one or more segments. The starts of these segments are defined by SEGMENT and the end of the segment is indicated by ENDS directive. Format Name SEGMENT

Name ENDS

27. Explain TITLE & TYPE

The TITLE directive helps to control the format of a listing of an assembled program. It causes a title for the program to print on line 2 of each page of the program listing. Maximum 60 characters are allowed. Format TITLE text. TYPE operator tells the assembler to determine the type of specified variable in bytes. For bytes the assembler gives a value 1, for word 2 & double word 4.

28 Define SOP

The segment override prefix allows the programmer to deviate from the default segment

Eg : MOV CS: [BX] , AL

29 Define variable.

A variable is an identifier that is associated with the first byte of data item. In assembly language statement: COUNT DB 20H, COUNT is the variable.

30. What are procedures?

Procedures are a group of instructions stored as a separate program in memory and it is called from the main program whenever required. The type of procedure depends on where the procedures are stored in memory. If it is in the same code segment as that of the main program then it is a near procedure otherwise it is a far procedure.

31. Explain the linking process.

A linker is a program used to join together several object files into one large object file. The linker produces a link file which contains the binary codes for all the combined modules. It also produces a link map which contains the address information about the link files. The linker does not assign Absolute addresses but only relative address starting from zero, so the programs are relocatable & can be put anywhere in memory to be run.

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35. Compare Procedure & Macro.

Procedur	Macro
Accessed by CALL & RET instruction during program execution	Accessed during assembly with name to macro when defined
Machine code for instruction is put only once	Machine code is generated for instruction each time when macro is called
With procedur less memory is required	With macro more memory is required
Parameters can be passed in registers, memory locations or stack	Parameters passed as part of statement which

36. What is the maximum memory size that can be addressed by 8086?
 In 8086, an memory location is addressed by 20 bit address and the address bus is 20 bit address and the address bus is 20 bits. So it can address up to one mega byte (2^{20}) of memory space.

PART-B

1. (a) Write an assembly language program in 8086 to search the largest data in the array (10)
 (b) Explain the various status flags in 8086 (6)
2. (a) Discuss the various addressing modes of 8086 (10)
 (b) Explain the following assembler directive in 8086 (6)
 - i. ASSUME
 - ii. EQU
 - iii. DW
3. (a) Write short notes on Macro (6)
 (b) Explain the function of assembler directives (10)
4. Explain the architecture of 8086 (16)
5. (a) Explain the register organization of 8086 (10)
 (b) Explain the pin diagram of 8086 (6)
6. Discuss the instruction set of 8086 in detail (16)

UNIT –II SYSTEM BUS STRUCTURE

1. Differentiate between minimum and maximum mode

Minimum mode	Maximum mode
i. A processor is in minimum mode when MN/MX pin is strapped to +5V.	A processor is in maximum mode when MN/MX is grounded.
ii. All the control signals are given out by microprocessor chip itself.	The processor derive the status signals S2 , S1 and S0. Another chip called bus controller derives control signals using this status information.
iii. There is a single microprocessor.	There may be more than one microprocessor.

2. Give any four pin definitions for the minimum mode.

Symbol	Description
i. INTA	Indicates recognition of an interrupt request. Consists of two negative going pulses in two consecutive bus cycles.
ii. ALE	Outputs a pulse at the beginning of the bus cycle and to indicate an address available on address pins.
iii. HLDA	Outputs a bus grant to a requesting master.
iv. HOLD	Receives bus requests from bus masters.

3. What are the pins that are used to indicate the type of transfer in minimum mode?
 The M/IO, RD, WR lines specify the type of transfer. It is indicated in the following table:

M/IO	RD	WR	
0	0	1	I/O Read
0	1	0	I/O Write
1	0	1	Memory read
1	1	0	Memory write.

4. What are the functional parts of 8086 CPU?

The two independent functional parts of the 8086 CPU are:

i. Bus Interface Unit (BIU):

BIU sends out addresses, fetches instruction from memory, reads data from ports and memory and writes data to ports and memory.

ii. Execution Unit (EU):

EU tells the BIU where to fetch instructions or data, decodes instructions and executes instructions.

5. What is the operation of S0, S1 and S2 pins in maximum mode?

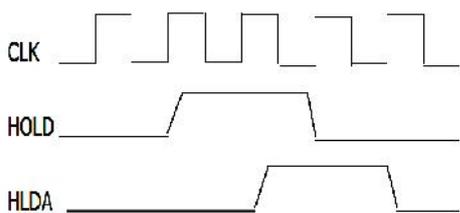
S2, S1, S0 indicates the type of transfer to take place during the current bus cycle.

S ₂	S ₁	S ₀	
0	0	0	- Interrupt acknowledge
0	0	1	- Read I/O port
0	1	0	- Write I/O port
0	1	1	- Halt
1	0	0	- Instruction fetch
1	0	1	- Read Memory
1	1	0	- Write Memory
1	1	1	- Inactive.

6. Give any four pin definitions for maximum mode.

Symbol	Description
QS1, QS0	Reflects the status of the instruction queue. This status indicates the activity in the queue during the previous clock cycle.
LOCK	Indicates that the bus is not to be relinquished to other potential bus masters.
RQ/GT1	For inputting bus requests and outputting bus grants.
RQ/GT0	Same as RQ/GT1 except that a request on RQ/GT0 has higher priority.

7. Draw the bus request and bus grant timings in minimum mode system.



Bus request and bus grant timings in minimum

8. What is the purpose of a decoder in EU?

The decoder in EU translates instructions fetched from memory into a series of actions, which the EU carries out.

9. Give the register classification of 8086.

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.

10. What are general data registers?

The registers AX, BX, CX and DX are the general data registers.

AX	AH	AL
BX	BH	BL
CX	CH	CL
DX	DH	DL

L

L and H represents the lower and higher bytes of particular register.

AX register is used as 16-bit accumulator.

BX register is used as offset storage for forming physical addresses in case of certain addressing modes.

CX register is used as a default counter in case of string and loop instructions.

DX register is used as an implicit operand or destination in case of a few instructions.

11. Give the different segment registers.

The four segment registers are:

- i. Code segment register: It is used for addressing a memory location in the code segment of the memory, where the executable program is stored.
- ii. Data segment register: It points to the data segment of the memory, where data is resided.
- iii. Extra segment register: It also contains data.
- iv. Stack segment register: It is used for addressing stock segment of memory. It is used to store stack data.

12. What are pointers and index registers?

IP, BP and SP are the pointers and contain offsets within the code, data and stack segments respectively. SI and DI are the index registers, which are used as general purpose registers

and also for offset storage in case of indexed, based indexed and relative based indexed addressing modes.

13. How is the physical address calculated? Give an example.

The physical address, which is 20-bits long is calculated using the segment and offset registers, each 16-bits 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

14. 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.

15. What are the advantages of segmented memory?

The advantages of segmented memory are:

- i. Allows the memory capacity to be 1Mbyte, although the actual addresses to be handled are of 16-bit size.
- ii. Allows the placing of code, data and stack portions of the same program in different parts of memory for data and code protection.
- iii. Permits a program and/or its data to be put into different areas of memory, each time program is executed i.e., provision for relocation may be done.

16. What is pipelining?

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

17. What are the two parts of a flag register?

The two parts of the 16 bit flag register are:

i. Condition code or status flag register:

It consists of six flags to indicate some condition produced by an instruction.

ii. Machine control flag register:

It consists of three flags and are used to control certain operations of the processor

18. Draw the format of 8086 flag register.

8086 flag register:

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

- U-Undefined
- CF - Carry flag
- PF - Parity flag
- AF - Auxiliary flag
- ZF - Zero flag
- SF - Sign flag
- TF - Single step trap flag
- DF - Direction flag
- IF - Interrupt enable flag
- OF - Overflow flag

19. Explain the three machine control flags.

i. Trap flag:

If this flag is set, the processor enters the single step execution.

ii. Interrupt flag: If this flag is set, the markable interrupts are recognized by the CPU, otherwise they are ignored.

iii. Direction flag: This is used by string manipulation instructions. If this flag bit is „0“, the string is processed from the lowest to the highest address i.e., auto incrementing mode. Otherwise, the string is processed from highest address to lowest address, i.e., auto decrementing mode.

20. 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 signals having special functions for maximum mode.

21. What are the uses of AD15 – AD0 lines?

AD15 – AD0 are time multiplexed memory I/O address and data lines. Address remains on the lines during T1 state, while data is available on data bus during T2, T3, Tw and T4 states. These lines are active high and float to a tristate during interrupt acknowledge and local bus hold acknowledge cycles.

22. What is the operation of RD signal?

RD is an active low signal. When it is low, it indicates the peripherals that the processor is performing a memory or I/O read operation.

23. Give the function of i. Ready and ii. INTR signal.

i. Ready signal: It is an acknowledgement from slow devices of memory that they have completed data transfer. The signal is synchronized by 8284 A clock generator to give ready input to 8086. The signal is active high.

ii. INTR signal: It is a level triggered input. This is sampled during the last cycle of each instruction to determine the availability of the request. If any interrupt request is pending, the processor enters the interrupt acknowledge cycle. This can be internally masked by resetting the interrupt enable flag. The signal is active high and internally synchronized.

24. What is the operation performed when TEST input is low?

When the TEST input is low, execution will continue, else, the processor remains in an idle state.

25. What is NMI (Non-Maskable Interrupt)?

NMI is an edge-triggered input, which causes a type 2 interrupt. It is not maskable internally by software and transition from low to high initiate the interrupt response at the end of the current instruction. This input is internally synchronized.

22. What is the purpose of clock input?

The clock input provides the basic timing for processor operation and bus control activity. It is an asymmetric square wave with 33% duty cycle. The range of frequency varies from 5MHz to 10MHz.

23. What is the function of MN/MX pin?

The logic level at MN/MX pin decides whether processor operates in minimum or maximum mode.

24. What happens when a high is applied to RESET pin?

When a high is given to RESET pin, the processor terminates the current activity and starts executing from FFFF0H. It must be active for at least four clock cycles. It is internally synchronized.

25. What will happen when a DMA request is made, while the CPU is performing a memory or I/O cycles?

When a DMA request is made, while the CPU is performing a memory or I/O cycles, it will request the local bus during T4 provided:

- i. The request occurs on or before T2 state of the current cycle.
- ii. The current cycle is not operating over the lower byte of a word.
- iii. The current cycle is not the first acknowledge of an interrupt acknowledge sequence.
- iv. A lock instruction is not being executed.

26. What is multiprogramming?

If more than one process is carried out at the same time, then it is known as multiprogramming. Another definition is the interleaving of CPU and I/O operations among several programs is called multiprogramming. To improve the utilization of CPU and I/O devices, we are designing to process a set of independent programs concurrently by a single CPU. This technique is known as multiprogramming.

27. Write the advantages of loosely coupled system over tightly coupled systems?

1. More number of CPUs can be added in a loosely coupled system to improve the system performance
2. The system structure is modular and hence easy to maintain and troubleshoot.
3. A fault in a single module does not lead to a complete system breakdown.

28. What are the different clock frequencies used in 80286?

Various versions of 80286 are available that run on 12.5MHz, 10MHz and 8MHz clock frequencies.

29. Define swapping in?

The portion of a program is required for execution by the CPU, it is fetched from the secondary memory and placed in the physical memory. This is called 'swapping in' of the program.

30. What are the different operating modes used in 80286?

The 80286 works in two operating modes

1. Real addressing mode
2. Protected virtual address mode.

31. What are the CPU contents used in 80286?

The 80286 CPU contains almost the same set of registers, as in 8086

- Eight 16-bit general purpose register
- Four 16-bit segment registers
- Status and control register
- Instruction pointer.

PART-B

1. (a) Draw and explain the maximum mode of 8086 (12)
(b) List the advantages of multiprocessor system (4)
2. (a) Explain the functions of (8)
 - i. HLDA
 - ii. RQ/GT0
 - iii. DEN
 - iv. ALE
(b) Draw and explain the minimum mode of 8086 (8)
3. (a) Draw and explain the block diagram of minimum mode of operation (12)
(b) Write notes on addressing memory (4)
4. Define the bus cycle and minimum mode read and write bus cycles with proper timing diagram (16)
5. (a) Draw the input and output timing diagram of maximum mode of operation in 8086 (10)
(b) Explain the addressing capabilities of 8086 (6)

MICROPROCESSOR & MICROCONTROLLER

UNIT-III I/O INTERFACING

1. What is memory mapped I/O?

This is one of the techniques for interfacing I/O devices with μ p. In memory mapped I/O, the I/O devices assigned and identified by 16-bit addresses. To transfer the data between MPU and I/O devices memory related instructions (such as LDA, STA etc.) and memory control signals (MEMR, MEMW) are used.

2. What is I/O mapped I/O?

This is one of the techniques for interfacing I/O devices with μ p. 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.

3. What is simplex and duplex transmission?

Simplex transmission: data are transmitted in only one direction. Duplex transmission: data flow in both directions. If the transmission goes one way at a time, it is called half duplex; if it goes both way simultaneously, then it is called full duplex

4. Define Baud.

The rate at which the bits are transmitted, bits per second is called Baud.

5. What are the signals available for serial communication?

SID – serial input data

SOD – serial output data

6. What is USART?

It is a programmable device. Its function and specification for serial I/O can be determined by writing instructions in its internal registers. The Intel 8251A USART is a device widely used in serial I/O.

7. Write the features of 8255A.

The 8255A has 24 I/O pins that can be primarily grouped primarily in two 8-bit Parallel ports: A and B, with eight bits as port C. The 8-bits of port C can be used as two 4-bit ports: C UPPER CU and C LOWER CL.

8. What is BSR mode?

All functions of 8255 are classified according to 2 modes. In the control word, if $D7 = 0$, then it represents bit set reset mode operation. The BSR mode is used to set or reset the bits in port C.

9. What is mode 0 operation of 8255?

In this mode, ports A and B are used as two simple 8-bit I/O ports and port C as two 4-bit ports. Each port can be programmed to function as an input port or an output port. The input/ output features in mode 0 as follows:

i. outputs are latched

ii. inputs are not latched

iii. ports do not have handshake or interrupt capability.

10. What are the modes of operation supported by 8255?

i. Bit set reset mode(BSR)

ii. I/O mode

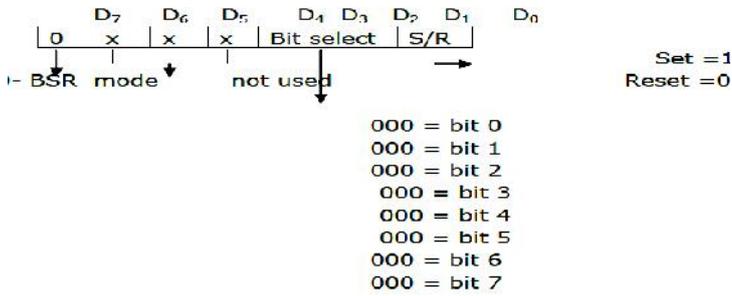
Mode 0

Mode 1

Mode 2

MICROPROCESSOR & MICROCONTROLLER

11. Write the control word format for BSR mode.



12. What is ADC and DAC?

The electronic circuit that translates an analog signal into a digital signal is called analog-to-digital converter(ADC).

The electronic circuit translates a digital signal into an analog signal is called Digital-to-analog converter(DAC).

13. Define conversion time.

It is defined as the total time required to convert an analog signal into a digital output. It is determined the conversion technique used and by the propagation delay in various circuits.

14. What are the functions to be performed by μp while interfacing an ADC?

- i. Send a pulse to the START pin.
- ii. Wait until the end of conversion
- iii. Read the digital signal at an input port

15. Write the different types of ADC.

- i. Single slope ADC
- ii. Dual slope ADC
- iii. Successive approximation ADC
- iv. Parallel comparator type ADC
- v. Counter type ADC

16. What is resolution time in ADC?

It is defined as a ratio of change in value of input voltage V_i , needed to change the digital output by 1 LSB. If the full scale input voltage required to cause a digital output of all 1's is V_{iFS} . Then the resolution can be given as

$$\text{Resolution} = V_{iFS} / (2^n - 1)$$

17. List the functions performed by 8279.

- i. It has built-in hardware to provide key debounce.
- ii. It provides a scanned interface to a 64 contact key matrix.
- iii. It provides multiplexed display interface with blanking and inhibit options.
- iv. It provides three input modes for keyboard interface.

18. What is key debounce?

The push button keys when pressed, bounces a few times, closing and opening the contacts before providing a steady reading. So reading taken during bouncing may be faulty. Therefore the microprocessor must wait until the key reach to steady state. This is known as key debounce.

MICROPROCESSOR & MICROCONTROLLER

19. What are the operating modes in 8279?

- i. Scanned keyboard mode
- ii. Scanned sensor matrix
- iii. Strobed input

20. What is N-key rollover?

In N-key rollover each key depression is treated independently from all others. When a key is depressed, the debounce logic is set and 8279 checks for key depress during next two scans.

21. Find the program clock command word if external clock frequency is 2 MHz.

Prescaler value = $(2 \times 10^6) / (100 \times 10^3) = (10100)_2$

Therefore command word = $(00110100)_2$

22. What is multiple interrupt processing capability?

Whenever a number of devices interrupt a CPU at a time, and if the processor is able to handle them properly, it is said to have multiple interrupt processing capability

23. What is hardware interrupt?

An 8086 interrupt can come from any one of three sources. One source is an external signal applied to the nonmaskable interrupt (NMI) input or to the interrupt (INTR) input pin. An interrupt caused by the signal applied to one of these inputs is referred to as a hardware interrupt.

24. What is software interrupt?

The interrupt caused due to execution of interrupt instruction is called software interrupt.

25. What are the two types of interrupts in 8086?

The two types of interrupts are:

i. External interrupts:

In this, the interrupt is generated outside the processor.

Example: Keyboard interrupt.

ii. Internal interrupts:

It is generated internally by the processor circuit or by the execution of an interrupt instruction.

Example: Zero interrupt, overflow interrupt.

PART B

1. Draw the block diagram of 8279 and explain the function of each. (16)
2. With the help of neat diagram explain how 8251 is interfaced with 8085 and used for serial communication (16)
3. Discuss the silent feature of 8259 and explain the block diagram of 8259- programmable interrupts controllers (16)
4. (a) Describe the various modes of operation in 8253 programmable internal timer (8)
- (b) Explain the operation of DMA controller 8237 (8)
5. (a) Draw and explain the interfacing of cascaded 8259 with 8086 (10)
- (b) Explain in detail with the modes of operation of 8255 (6)
6. Draw the pin diagram of 8257 programmable DMA controller and explain the function of each pin in detail (16)
7. Discuss the various operating modes of 8253 timer with necessary control words (16)

UNIT-IV MICROCONTROLLER

MICROPROCESSOR & MICROCONTROLLER

1. What are the special function register?

The special function register are stack pointer, index pointer (DPL and DPH), I/O port addresses, status(PSW) and accumulator.

2. What are the uses of accumulator register?

The accumulator registers (A and B at addresses OE0h and OF0h, respectively) are used to store temporary values and the results of arithmetic operations.

3. What is PSW?

Program status word (PSW) is the set of flags that contains the status information and is considered as one of the special function register.

4. 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.

5. What is data pointer (DTPR)?

It is a 16-bit register that contains a higher byte (DPH) and lower byte (DPL) of a 16-bit external data RAM address.

It is accessed as a 16-bit register or two 8-bit registers. It has been allotted two addresses in the special function register bank, for its two bytes DPH and DPL.

6. Why oscillator circuit is used?

Oscillator circuit is used to generate the basic timing clock signal for the operation of the circuit using crystal oscillator.

7. What is the purpose of using instruction register?

Instruction register is used for the purpose of decoding the opcode of an instruction to be executed and gives information to the timing and control unit generating necessary signals for the execution of the instruction.

8. Give the purpose of ale/prog signal.

ALE/PROG is an address latch enable output pulse and indicates that valid address bits available on the respective pins.

The ALE pulses are emitted at a rate of one-sixth of the oscillator frequency. The signal is valid only for external memory accesses.

It may be used for external timing or clockwise purpose. One ALE pulse is skipped during each access to external data memory.

9. Explain the two power saving mode of operation.

The two power saving modes of operation are:

I. Idle mode:

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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.

10. Differentiate between program memory and data memory.

i. It stores the programs to be executed.

ii. It stores only program code which is to be executed and thus it need not be written, so it is implemented using EPROM. It stores the data, line intermediate results, variables and constants required for the execution of the program.

The data memory may be read from or written to and thus it is implemented using RAM.

11. What are addressing modes?

The various ways of accessing data are called addressing modes.

12. Give the addressing modes of 8051?

There are six addressing modes in 8051. They are

- . Direct addressing
- . Indirect addressing
- . Register instruction
- . Registerspecific (register implicit)
- . Immediate mode
- . Indexed addressing

13. What is direct addressing mode?

The operands are specified using the 8-bit address field, in the instruction format. Only internal data Ram and SFRs can be directly addressed. This is known as direct addressing mode.

Eg: Mov R0, 89H

14. What is indirect addressing mode?

In this mode, the 8-bit address of an operand is stored in a register and the register, instead of the 8-bit address, is specified in the instruction. The registers R0 and R1 of the selected bank of registers or stack pointer can be used as address registers for storing the 8-bit addresses.

The address register for 16-bit addresses can only be „data pointer“ (DPTR).

Eg: ADD A, @ R0.

15. What is meant by register instructions addressing mode?

The operations are stored in the registers R0 – R7 of the selected register bank. One of these eight registers (R0 – R7) is specified in the instruction using the 3-bit register specification field of the opcode format. A register bank can be selected using the two bank select bits of the PSN. This is called as register instruction addressing mode

Eg: ADD A, R7.

16. What is immediate addressing mode?

An immediate data ie., a constant is specified in the instruction, after the opcode byte.

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Eg: MOV A, #100

The immediate data 100 (decimal) is added to the contents of the accumulator. For specifying a hex number, it should be followed by H. These are known as immediate addressing mode.

17. What is indexed addressing?

This addressing mode is used only to access the program memory. It is accomplished in 8051 for look-up table manipulations. Program counter or data pointer are the allowed 16-bit address storage registers, in this mode of addressing. These 16-bit registers point to the base of the look-up table and the ACC register contains a code to be converted using the look-up table. The look-up table data address is found out by adding the contents of register ACC with that of the program counter or data pointer.

In case of jump instruction, the contents of accumulator are added with one of the specified 16-bit registers to form the jump destination address.

Eg: MOV C, A @ A + DPTP

JMP @ A + DPTR

18. List the five addressing modes of 8051 microcontroller.

The five addressing modes are,

- I. Immediate addressing
- II. Register addressing
- III. Direct addressing
- IV. Register indirect addressing
- a. Indexed addressing.

19. 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.

20. WHAT IS SFR?

In the 8051 microcontroller registers A, B, PSW and DPTR are part of the group of registers commonly referred to as special function registers (SFR).

21. WHAT ARE THE TWO MAIN FEATURES OF SFR ADDRESSES?

The following two points should be noted SFR addresses. The special function registers have addresses between 80H and FFH. These addresses are above 80H, since the addresses 00 to 7FH are addresses of RAM memory inside the 8051.

II. Not all the address space of 80 to FH is used by the SFR. The unused locations 80H to FFH are reserved and must not be used by the 8051 programmer.

22. What is the difference between direct and register indirect addressing mode?

Loop is most efficient and is possible only in register indirect addressing whereas looping is not direct addressing mode.

23 List out some compare instructions.

The compare instructions are:

- a. CJNE
- b. CLR
- c. CPL
- SCE

MICROPROCESSOR & MICROCONTROLLER 24 Write a program to save the

accumulator in r7 of bank 2.

```
CLR PSW – 3
SETB PSW – 4
MOV R7, A.
```

25. What are single bit instructions? Give example.

Instructions that are used for single bit operation are called single bit instructions.

Examples: SETB bit

```
CLR bit
CPL bit
```

26. Write a program to save the status of bits p1.2 and p1.3 on ram bit LOCATIONS 6 AND 7 RESPECTIVELY.

```
MOV C, P1.2; save status of P1.2 on CY
MOV O6, C; save carry in RAM bit location 06
MOV C, p1.3; save status of p1.3 on CY
MOV O7, C; save carry in RAM bit location 07.
```

27. Write a program to see if bits 0 and 5 of register b r1. If they are not, make them so and save it in r0.

```
JNB OF0H, NEXT – 1; JUMP if B.0 is low
SET BOFOH; Make bit B.0 high
NEXT – 1:JNB OF5H, NEXT – 2; JUMP if B.5 is low
SETB OF5H; Make B.5 high
NEXT – 2: MOV R0, B; Save register B.
```

PART-B

1. With the necessary diagram of control word format, explain the various operating modes of timer in 8051 microcontroller
- 2.(a) With the help of neat diagram explain the memory organization of 8051 microcontroller
3. With neat sketch explain the architecture of 8051 microcontroller.

Block Diagram

Explanation about all blocks in the block diagram

4. Draw the Pin Diagram of 8051 and explain the function of various signals.

5. List the various Instructions available in 8051 microcontroller.

Data Transfer Instructions

Arithmetic Instructions

Logical Instructions

Boolean variable Manipulation Instructions

Program and Machine Control Instructions

UNIT-V INTERFACING MICROCONTROLLERS

1. 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

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2. 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 TH0 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., 80H to FF.

3. What is the use of timing and control unit?

Timing and control unit is used to derive all the necessary timing and control signals required for the internal operation of the circuit. It also derives control signals that are required for controlling the external system bus.

4. 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.

5. Explain the mode (0 and 1) operation of the timer.

The operations are as follows:

- Timer mode 0 and 1 operations are similar for the 13 bit (mode 0) 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.

6. What is 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.

7. 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.

8. Define interrupt.

Interrupt is defined as request that can be refused. If not refused and when an interrupt request is acknowledged, a special set of routine or events are followed to handle the interrupt.

7. What are the steps followed to service an interrupt?

The steps followed are:

- I. Save the context register information.
- II. Reset the hardware requesting the interrupt.
- III. Reset the interrupt controller.
- IV. Process the interrupt.
- V. Restore the context information.
- VI. Return to the previously executing code.

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8. How can 8051 be interrupted?

There are five different ways to interrupt 8051. Two of these are from external electrical signals. The other three are caused by internal 8051 I/O hardware operations.

9. 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.

10. What is meant by nesting of interrupts?

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

11. 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.

12. 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).

13. Give an application for synchronous serial communication.

An application for synchronous serial communication is RS – 232.

14. When is an external memory access generated in 8051?

In 8051, during execution the data is fetched continuously. Most of the data is executed out of the 8051's built-in control store. When an address is outside the internal control store, an external memory access is generated.

15. Give the priority level of the interrupt sources.

Interrupt source Priority within a level

IE0 (External INT0)

TF0(Timer 0)

IE 1 (External INT 1)

TF 1 (Timer 1)

RI = TI (Serial port) Highest

MICROPROCESSOR & MICROCONTROLLER

.
.
Lowest

16. What is the use of stepper motor?

A stepper motor is a device used to obtain an accurate position control of rotating shafts. A stepper motor employs rotation of its shaft in terms of steps, rather than continuous rotation as in case of AC or DC motor.

17. What is meant by key bouncing?

Microprocessor must wait until the key reach to a steady state; this is known as Key bounce

PART-B

1. With neat sketch explain the functions of 8255 PPI.

Block Diagram

Explanation about all the ports available.

Explanation about the modes of transfer

Explain the control Word Register

2. With neat sketch explain the functions of 8251.

Block Diagram

Types of data transfer

Explanation about all the blocks.

Explain the control Word Register, Status Register

3. With neat sketch explain the function of DMA controller.

Block Diagram

Explanation about all blocks in the block diagram

With neat sketch explain the function of Programmable Interrupt Controller.

Block Diagram

Explanation about all blocks in the block diagram

4. With neat sketch explain the function of Keyboard and display controller.

Block Diagram

Types of Display Available

Types of keys available

Explanation about all blocks in the block diagram

5. With neat sketch explain the function of A/D converter.

Fundamental steps

Figure

Explain the functions.

6. With neat sketch explain the function of D/A converter.

Fundamental steps

Figure

Explain the functions.