# Techno India NJR Institute of Technology


# Course File

# Microcontroller (4EC4-05)

# Session (2022-23)

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# RAJASTHAN TECHNICAL UNIVERSITY, KOTA

**SYLLABUS**

**II Year - IV Semester: B.Tech. (Electronics & Communication Engineering)**

## 4EC4-05: Microcontrollers

**Credit: 3** **Max. Marks: 150(IA:30, ETE:120)**

**3L+0T+0P** **End Term Exam: 3 Hours**

| SN | Contents | Hours |
|---|---|---|
| 1 | **Introduction:** Objective, scope and outcome of the course. | 1 |
| 2 | Overview of microcomputer systems and their building blocks, memory interfacing, concepts of interrupts and Direct Memory Access, instruction sets of microprocessors (with examples of 8085 and 8086); | 10 |
| 3 | Interfacing with peripherals - timer, serial I/O, parallel I/O, A/D and D/A converters; Arithmetic Coprocessors; System level interfacing design; | 8 |
| 4 | Concepts of virtual memory, Cache memory, Advanced coprocessor Architectures- 286, 486,<br>Pentium; Microcontrollers: 8051 systems. | 10 |
| 5 | Introduction to RISC processors; ARM microcontrollers interface designs. | 11 |
| | **Total** | 40 |

## Course Overview:

The objective of this course is to enable the students to understand embedded-system programming and apply that knowledge to design and develop embedded solutions. Interaction with peripheral devices. Identify hardware and software components to build an embedded system.

## Course Outcomes:

| CO.NO. | Cognitive Level | Course Outcome |
|---|---|---|
| 1 | **Comprehension** | Basic knowledge of assembly language and C language. |
| 2 | **Application** | Use interfacing circuit for peripherals like, I/O, A/D, D/A, timer etc |
| 3 | **Analysis** | Categorize different types of microcontrollers on the basis of speed, power consumption and response time. |
| 4 | **Synthesis** | Design and develop interfacing circuit for memory organization. |
| 5 | **Evaluate** | Compare RSIC architecture with CICS architecture based systems. |

## Prerequisites:

1. Fundamentals knowledge of binary number system.
2. Fundamentals knowledge of digital electronics.
3. Fundamentals knowledge of sequential and combinational circuit.

## Course Outcome Mapping with Program Outcome:

| Course Outcome | Program Outcomes (PO's) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO. NO. | Domain Specific | | | | | Domain Independent | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| CO1 | 0 | 0 | 2 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| CO2 | 0 | 0 | 2 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| CO3 | 1 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| CO4 | 2 | 2 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 |
| CO5 | 0 | 0 | 2 | 2 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High) | | | | | | | | | | | | |

**Course Coverage Module Wise:**

| Lecture No. | Unit | Topic |
|---|---|---|
| 1 | **1** | **ZERO LECTURE** |
| 2 | **2** | **OVERVIEW OF MICROCOMPUTER SYSTEMS AND THEIR BUILDING BLOCKS** |
| 3 | 2 | Overview of microcomputer systems and their building blocks |
| 4 | 2 | Memory interfacing |
| 5 | 2 | Memory interfacing |
| 6 | 2 | Concepts of interrupts |
| 7 | 2 | Direct Memory Access |
| 8 | 2 | Direct Memory Access |
| 9 | 2 | Instruction sets of microprocessors (with examples of 8085 and 8086) |
| 10 | 2 | Instruction sets of microprocessors (with examples of 8085 and 8086) |
| 11 | 2 | Instruction sets of microprocessors (with examples of 8085 and 8086) |
| 12 | **3** | **INSTRUCTION SETS OF MICROPROCESSORS (WITH EXAMPLES OF 8085 AND 8086)** |
| 13 | 3 | Interfacing with peripherals |
| 14 | 3 | Timer |
| 15 | 3 | Serial I/O |
| 16 | 3 | Parallel I/O |
| 17 | 3 | A /D and D/A converters |
| 18 | 3 | A /D and D/A converters |
| 19 | 3 | Arithmetic Coprocessors |
| 20 | **4** | **SYSTEM LEVEL INTERFACING DESIGN** |
| 21 | 4 | Concepts of virtual memory, Cache memory |
| 22 | 4 | Concepts of virtual memory, Cache memory |

| | | |
|---|---|---|
| 23 | 4 | Advanced coprocessor Architectures- 286, 486, Pentium |
| 24 | 4 | Advanced coprocessor Architectures- 286, 486, Pentium |
| 25 | 4 | Advanced coprocessor Architectures- 286, 486, Pentium |
| 26 | 4 | Microcontrollers: 8051 systems |
| 27 | 4 | Microcontrollers: 8051 systems |
| 28 | 4 | Microcontrollers: 8051 systems |
| 29 | 4 | Microcontrollers: 8051 systems |
| 30 | **5** | **MICROCONTROLLERS: 8051 SYSTEMS** |
| 31 | 5 | Introduction to RISC processors |
| 32 | 5 | Introduction to RISC processors |
| 33 | 5 | Introduction to RISC processors |
| 34 | 5 | ARM microcontrollers interface designs |
| 35 | 5 | ARM microcontrollers interface designs |
| 36 | 5 | ARM microcontrollers interface designs |
| 37 | 5 | ARM microcontrollers interface designs |
| 38 | 5 | ARM microcontrollers interface designs |
| 39 | 5 | Spill Over Classes |
| 40 | 5 | Spill Over Classes |

**TEXT and Reference Book**


1. Microprocessor Architecture: Programming and Applications ith the 8085/8080A, R. S. Gaonkar ,Penram International Publishing, 1996
2. Computer Organization and Design The hardware and software interface D A Patterson and J H Hennessy ,Morgan Kaufman Publishers.

3. Microprocessors Interfacing, Douglas Hall, Tata McGraw Hill, 1991.
4. The 8051 Microcontroller, Kenneth J. Ayala, Penram International Publishing, 1996.

**QUIZ Link**
https://www.sanfoundry.com/microcontroller-mcqs-introduction/
https://www.indiabix.com/digital-electronics/the-8051-microcontroller/

**NPTEL COURSES LINK**
https://archive.nptel.ac.in/courses/108/105/108105102/

**Faculty Notes Link**
https://drive.google.com/drive/folders/1L6NtNyjJPFW-pA0ewsewVbkr0a_p0XEV?usp=drive_link

**Assessment Methodology:**
1. Practical exam using Keil Compiler.
2. Two Midterm exams where student have to showcase subjective learning.
3. Final Exam (subjective paper) at the end of the semester.

# Microprocessor Lab Viva Questions with Answers

1.What is a Microprocessor?
Microprocessor is a CPU fabricated on a single chip, program-controlled device, which fetches the instructions from memory, decodes and executes the instructions.

2. What is Instruction Set?
It is the set of the instructions that the Microprocessor can execute.

3. What is Bandwidth ?
The number of bits processed by the processor in a single instruction.

4. What is Clock Speed ?
Clock speed is measured in the MHz and it determines that how many instructions a processor can processed. The speed of the microprocessor is measured in the MHz or GHz.

5. What are the features of Intel 8086 ?
Features:

- Released by Intel in 1978
- Produced from 1978 to 1990s
- A 16-bit microprocessor chip.
- Max. CPU clock rate:5 MHz to 10 MHz
- Instruction set: x86-16
- Package: 40 pin DIP
- 16-bit Arithmetic Logic Unit
- 16-bit data bus (8088 has 8-bit data bus)
- 20-bit address bus - 220 = 1,048,576 = 1 meg
- The address refers to a byte in memory.
- In the 8088, these bytes come in on the 8-bit data bus. In the 8086, bytes at even addresses come in on the low half of the data bus (bits 0-7) and bytes at odd addresses come in on the upper half of the data bus (bits 8-15).
- The 8086 can read a 16-bit word at an even address in one operation and at an odd address in two operations. The 8088 needs two operations in either case.
- The least significant byte of a word on an 8086 family microprocessor is at the lower address.

6. What is Logical Address:?

- A memory address on the 8086 consists of two numbers, usually written in hexadecimal and separated by a colon, representing the *segment* and the *offset*. This combination of segment and offset is referred to as a *logical address*
- Logical address=segment: offset

7. What is The Effective Address:

- In general, memory accesses take the form of the following example:
- Mov ax, [*baseReg* + *indexReg* + *constant*]
- This example copies a word sized value into the register AX.
- Combined, the three parameters in brackets determine what is called the *effective address*, which is simply the offset referenced by the instruction

8. What is Physical Address?

Physical memory address pointed by SEGMENT:OFFSET pair is calculated as:

Physical address = (<Segment Addr> * 10) + <Offset Addr>

9.What are the flags in 8086?

In 8086 Carry flag, Parity flag, Auxiliary carry flag, Zero flag, Overflow flag, Trace flag, Interrupt flag, Direction flag, and Sign flag.

10.Why crystal is a preferred clock source?
Because of high stability, large Q (Quality Factor) & the frequency that doesn't drift with aging. Crystal is used as a clock source most of the times.

11.What is Tri-state logic?
Three Logic Levels are used and they are High, Low, High impedance state. The high and low are normal logic levels & high impedance state is electrical open circuit conditions. Tri-state logic has a third line called enable line.

12.What happens when HLT instruction is executed in processor?
The Micro Processor enters into Halt-State and the buses are tri-stated.

13.What is Program counter?
Program counter holds the address of either the first byte of the next instruction to be fetched for execution or the address of the next byte of a multi byte instruction, which has not been completely fetched. In both the cases it gets incremented automatically one by one as the instruction bytes get fetched. Also Program register keeps the address of the next instruction.

14.What is 1st / 2nd / 3rd / 4th generation processor?
The processor made of PMOS / NMOS / HMOS / HCMOS technology is called 1st / 2nd / 3rd / 4th generation processor, and it is made up of 4 / 8 / 16 / 32 bits.

15.Name the processor lines of two major manufacturers?
High-end: Intel - Pentium (II, III, 4), AMD - Athlon. Low-end: Intel - Celeron, AMD - Duron. 64-bit: Intel - Itanium 2, AMD - Opteron.

16.How many bit combinations are there in a byte?
Byte contains 8 combinations of bits.

17.Have you studied buses? What types?
There are three types of buses.
Address bus: This is used to carry the Address to the memory to fetch either Instruction or Data.
Data bus : This is used to carry the Data from the memory.
Control bus : This is used to carry the Control signals like RD/WR, Select etc.

18.What is the Maximum clock frequency in 8086?
5 Mhz is the Maximum clock frequency in 8086.

19.What is meant by Maskable interrupts?
An interrupt that can be turned off by the programmer is known as Maskable interrupt.

20.What is Non-Maskable interrupts?
An interrupt which can be never be turned off (ie. disabled) is known as Non-Maskable interrupt

21.What are the different functional units in 8086?
Bus Interface Unit and Execution unit, are the two different functional units in 8086.

22.What are the various segment registers in 8086?
Code, Data, Stack, Extra Segment registers in 8086.

23.What does EU do?
Execution Unit receives program instruction codes and data from BIU, executes these instructions and store the result in general registers.

24.Which Stack is used in 8086? k is used in 8086?
FIFO (First In First Out) stack is used in 8086.In this type of Stack the first stored information is retrieved first.

25.What are the flags in 8086?
In 8086 Carry flag, Parity flag, Auxiliary carry flag, Zero flag, Overflow flag, Trace flag, Interrupt flag, Direction flag, and Sign flag.

26.What is SIM and RIM instructions?
SIM is Set Interrupt Mask. Used to mask the hardware interrupts.
RIM is Read Interrupt Mask. Used to check whether the interrupt is Masked or not.

27.What are the different types of Addressing Modes?
A:- There are 12 different types of Addressing Modes.They are:-
<1> Immediate:-The Immediate data is a part of instruction, and appears in the form of successive bytes.

<2> Direct:-A 16-bit memory address(offset) is directly specified in the instruction as a part of it.

<3> Register:-Data is stored in a register and it is referred using the particular register (except IP).

<4> Register Indirect:-The address of the memory location which contains data or operand is determined in an indirect way.

<5> Indexed:-offset of the operand is stored in one of the index registers.

<6> Register Relative:-The data is available at an eefective address formed by adding an 8-bit or 16-bit displacement with the content of any one of the registers BX,BP,SI and DI in the default (either DS or ES) segment.

<7> Based Indexed:-The effective address of the data is formed,in this addressing mode,by adding content of a base register to the content of an index register.
<8> Relative Based Indexed:- The effective address is formed by adding an 8 or 16-bit displacement with the sum of contents of any one of the base registers and any one of the index registers,in the default segment.

<9> Intrasegment Direct Mode:-In this mode,the address to which the control is to bve transferred lies in the segment in which the control transfer instruction lies and appears directly in the instruction as an immediate displacement value.

<10> Intrasegment Indirect Mode:-In this mode,the displacement to which the control is to be transferred,is in the same segment in whgich the control transfer instruction lies,but it is passed to the instruction indirectly.
<11> Intersegment Direct:-In this mode,the address to which the control is to be transferred is in a different segment.
<12> Intersegment Indirect:-In this mode,the address to which the control is to be transferred lies in a different segment and it is passed to the instruction indirectly sequentially.

28.What are the General Data Registers & their uses?
A:- The Registers AX,BX,CX,DX are the general Purpose 16-bit registers.AX register as 16-bit accumulator.BX register is used as an offset Storage.CX register is used as default or implied counter.Dx register is used as an implicit operand or destination in case of a few instructions.

29.What are Segment Registers & their uses?
A:-There are 4 Segment Registers Code Segment(CS),Data Segment(DS),Extra Segment(ES) & Stack Segment(SS) registers.CS is used for addressing memory locationin code.DS is used to points the data.ES refers to a segment which is essentially in another data segment.SS is used fopr addressing stack segment of memory.

30.What are Flag registers?
A:-Divided into 2 parts:-Condition code or status flags and machine control flags.
S-Sign Flag:-Is to set when the result of any computation is negative.
Z-Zero Flag:-Is to set if the result of the computation or comparision performed by the previous instruction is zero.
C-Carry Flag:-Is set when there is carry out of MSB in case of addition or a borrow in case of subtraction.
T-Trap Flag:-Is set,the processor enters the single step execution mode.
I-Interrupt Flag:-Is set,the maskable interrupts are recognised by the CPU.
D-Direction Flag:-Is set for autoincrementing or autodecrementing mode in string manipulation instructions.
AC-Auxiliary Carry Flag:-Is set if there is a carry from the lowest nibble during addition or borrow for the lowest nibble.
O-Overflow Flag:-Is setif the result of a signed operation is large enough to be accommodated in a destination register.

31.What does the 8086 Architecture contain?
A:-The complete architecture of 8086 can be divided into 2types :-Bus Interface Unit(BIU) & Execution Unit.
The BIU contains the circuit for physical address calculations and a precoding instruction byte queue & it makes the bus signals available for external interfacing of the devices.
The EU contains the register set of 8086 except segment registers and IP.It has a 16-bit ALU,able to perform arithmetic and Logic operations.

32) What are Data Copy/Transfer Instructions?
A:- Mov
Push
Pop
Xchg
In
Out
Xlat
Lea
Lds/Les
Lahf
Sahf
Pushf
Popf

33. What are Machine Control Instructions?
A:- Nop
Hlt
Wait
Lock

34) What are Flag Manipulation Instructions?
A:- Cld
Std
Cli
Sti

35) What are String Instructions?
A:- Rep
MovSB/MovSW
Cmps

Scas
Lods
Stos

36) What are different parts for 8086 architecture?
A:- The complete architecture of 8086 can be divided into 2types :-Bus Interface Unit(BIU) & Execution Unit.
The BIU contains the circuit for physical address calculations and a precoding instruction byte queue & it makes the bus signals available for external interfacing of the devices.
The EU contains the register set of 8086 except segment registers and IP.It has a 16-bit ALU,able to perform arithmetic and Logic operations.

37.What is an Interrupts
Def:- An interrupt operation suspends execution of a program so that the system can take special action.The interrupt routine executes and normally returns control to the interrupted procedure, which then resumes execution.BIOS handles Int 00H-1FH, whereas DOS handles INT 20H-3FH.

38. What is an Opcode?
A:-The part of the instruction that specifies the operation to be performed is called the Operation code or Op code.

39.What is an Operand?
A:-The data on which the operation is to be performed is called as an Operand.

40.Explain the difference between a JMP and CALL instruction?
A:-A JMP instruction permantely changes the program counter.
A CALL instruction leaves information on the stack so that the original program execution sequence can be resumed.

41.What is meant by Polling?
A:- Polling or device Polling is a process which idenfies the device that has interrupted the microprocessor.

42.What is meant by Interrupt?
A:-Interrupt is an external signal that causes a microprocessor to jump to a specific subroutine.

43.What is an Instruction?
A:-An instruction is a binary pattern enetered through an input device to command the microprocessor to perform that specific function.

44.What is Microcontroller and Microcomputer?
A:- Microcontroller is a device that includes microprocessor:memory and I/O signal lines on a single chip,fabricated using VLSI technology.
Microcomputer is a computer that is designed using microprocessor as its CPU.It includes microprocessor,memory and I/O.

45.What is Assembler?
A:-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.

46.Define Variable?
A:-A Variable is an identifier that is associated with the first byte of data item.

47.Explain Dup?

A:-The DUP directive can be used to initialize several location & to assign values to these locations.

48.Define Pipelining?
A:-In 8086,to speedup the execution program,the instructions fetching and execution of instructions are overlapped each other.this is known as Pipelining.

49.What is the use of HLDA?
A:-HLDA is the acknowledgment signal for HOLD. It indicates whether the HOLD signal is received or not. HOLD and HLDA are used as the control signals for DMA operations.

50. Explain about "LEA"?
A:-LEA(Load Effective Address) is used for initializing a register with an offset address.
A common use for LEA is to intialize an offset in BX, DI or SI for indexing an address in memory.
An equivalent operation to LEA is MOV with the OFFSET operator, which generates slightly shorter machine code.

51. Difference between "Shift" and "Rotate".
A:-Shift and Rotate commands are used to convert a number to another form where some bits are shifted or rotated.
A rotate instruction is a closed loop instruction.That is,the data moved out at one end is put back in at the other end.
The shift instruction loses the data that is moved out of the last bit locations.
Basic difference between shift and rotate is shift command makes "fall of " bits at the end of the register. Where rotate command makes "wrap around" at the end of the register.

52. Explain about .MODEL SMALL?
A:- .MODEL directive:-This simplified segment directive creates default segments and the required ASSUME and GROUP statements.
Its format is .MODEL memory-model.The following are the memry models
Tiny:-Code and data in one segment, for .COM programs.
Small:-Code in one segment (<=64K), data in one segment (<=64K). It generates 16-bit offset addresses.
Medium:-Any number of code segments, data in one segment (<=64K).
Compact:-Code in one segment (<=64K), any number of data segments. It generates 32-bit adresses, which require more time for execution.
Large:-Code and data both in any number of segments, no array >64K.
Huge:-Code and data both in any number of segments, arrays may be >64K.
Flat:-Defines one area upto 4 gigabytes for both code and data.It is unsegmented.The program uses 32-bit adressing and runs under Windows in protected mode.

53.Difference between JMP and JNC?
A:-JMP is Unconditional Branch.
JNC is Conditional Branch.

54.List the String Manipulation Commands?
A:-REP=Repeat.
MOVS=Move Byte/Word
CMPS=Compare Byte/Word
SCAS=Scan Byte/Word
LODS=Load byte/Wd to AL/AX
STOS=Stor Byte/Wd from AL/A

55.What are the 4 Segments?
A:-Code Segment Register {CS}
Data Segment Register {DS}
Extra Segment Register {ES}
Stack Segment Register{SS}

56.What is the main use of ready pin?

A:-READY is used by the microprocessor to check whether a peripheral is ready to accept or transfer data.
A peripheral may be a LCD display or analog to digital converter or any other.
These peripherals are connected to microprocessor using the READY pin.
If READY is high then the periphery is ready for data transfer. If not the microprocessor waits until READY goes high.

57.Explain about Direction Flag?
A:-This is used by string manipulation instructions.
If this flag bit is 0 , the string is processed beginning from the lowest to the highest address,i.e.,.Autoincrement mode.
Otherwise,the string is processed from the highest towards the lowest address,i.e.,.Autodecrementing mode.

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

59.what is Software and Hardware?

The Software is a set of instructions or commands needed for performing a specific task by a programmable device or a computing machine.

The Hardware refers to the components or devices used to form computing machine in which the software can be run and tested. Without software the Hardware is an idle machine.

60.What is assembly language?

The language in which the mnemonics (short -hand form of instructions) are used to write a program is called assembly language. The manufacturers of microprocessor give the mnemonics.

61.What are machine language and assembly language programs?
The software developed using 1's and 0's are called machine language, programs. The software developed using mnemonics are called assembly language programs.

62. What is the drawback in machine language and assembly language, programs?

The machine language and assembly language programs are machine dependent. The programs developed using these languages for a particular machine cannot be directly run on another machine .

63. Define bit, byte and word.

A digit of the binary number or code is called bit. Also, the bit is the fundamental storage unit of computer memory.
The 8-bit (8-digit) binary number or code is called byte and 16-bit

binary number or code is called word. (Some microprocessor manufactures refer the basic data size operated by the processor as word).

64. What is a bus?
Bus is a group of conducting lines that carries data, address and control signals.

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

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

67. What is the function of microprocessor in a system?
The microprocessor is the master in the system, which controls all the activity of the system. It issues address and control signals and fetches the instruction and data from memory. Then it executes the instruction to take appropriate action.

68. What are the modes in which 8086 can operate?
The 8086 can operate in two modes and they are minimum (or uniprocessor) mode and maximum ( or multiprocessor) mode.

69. What is the data and address size in 8086?
The 8086 can operate on either 8-bit or 16-bit data. The 8086 uses 20 bit address to access memory and 16-bit address to access 1/0 devices.

Explain the function of M/IO in 8086.

The signal M/IO is used to differentiate memory address and 1/0 address When the processor is accessing memory locations MI 10 is asserted high and when it is accessing 1/0 mapped devices it is asserted low.

Write the flags of 8086.
The 8086 has nine flags and they are
1. Carry Flag (CF) 6. Overflow Flag (OF)
2. Parity Flag (PF) 7. Trace Flag (TF)
3. Auxiliary carry Flag (AF) 8. Interrupt Flag (IF)
4. Zero Flag (ZF) 9. Direction Flag (DF)
5. Sign Flag (SF)

16. What are the interrupts of 8086?

The interrupts of 8085 are INTR and NMI. The INTR is general maskable interrupt and NMI is non-maskable interrupt.

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

The 8086 does not have on-chip clock generation circuit. Hence the clock generator chip, 8284 is connected to the CLK pin of8086. The clock signal supplied by 8284 is divided by three for internal use. The maximum internal clock frequency of8086 is 5MHz.

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

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

Register Special function

1. AX 16-bit Accumulator
2. AL 8-bit Accumulator
3. BX Base Register 4. CX Count Register 5. DX .Data Register

19. What is pipelined architecture?

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

20. What are the functional units available in 8086 architecture?

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

21. List the segment registers of 8086.

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

22. Define machine cycle.

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

23. Define T-State.

T-State is defined as one subdivision of the operation performed in

one clock period. These subdivisions are internal states synchronized with the system clock, and each T-State is precisely equal to one clock period.

24. List the components of microprocessor (single board microcomputer) based system

The microprocessor based system consist of microprocessor as CPU, semiconductor memories like EPROM and RAM, input device, output device and interfacing devices.

25. Why interfacing is needed for 1/0 devices?

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

26. What is the difference between CPU bus and system bus?

The CPU bus has multiplexed lines but the system bus has separate lines for each signal. (The multiplexed CPU lines are demultiplexed by the CPU interface circuit to form system bus).

27..What does memory-mapping mean?

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

28..What is interrupt 1/0?

If the 1/0 device initiate the data transfer through interrupt then the 1/0 is called interrupt driven 1/0.

29. Why EPROM is mapped at the beginning of memory space in 8085

system?

In 8085 microprocessor, after a reset, the program counter will have

OOOOH address. If the monitor program is stored from this address then after a reset, it will be executed automatically. The monitor

program is a permanent program and stored in EPROM memory. If
EPROM memory is mapped at the beginning of memory space, i.e., at OOOOH, then the monitor program will be executed automatically after a reset.

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

32. What is the need for Port?

The I/O devices are generally slow devices and their timing
characteristics do not match with processor timings. Hence the I/O devices are connected to system bus through the ports.

33.What is a port?

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

34.Give some examples of port devices used in 8085 microprocessor based system?

The various INTEL I/O port devices used in 8085 microprocessor
based system are 8212, 8155, 8156, 8255, 8355 and 8755.

35. Write a short note on INTEL 8255?

The INTEL 8255 is a I/O port device consisting of 3 numbers of 8 -bit
parallel I/O ports. The ports can be programmed to function either as a input port or as a output port in different operating modes. It requires 4 internal addresses and has one logic LOW chip select pin.

36.What is the drawback in memory mapped I/0?

When I/O devices are memory mapped, some of the addresses are
allotted to I/O devices and so the full address space cannot be used for addressing memory (i.e., physical memory address space will be reduced). Hence memory mapping is useful only for small systems, where the memory requirement is less.

37. How DMA is initiated?

When the I/O device needs a DMA transfer, it will send a DMA request signal to DMA controller. The DMA controller in turn sends a HOLD request to the processor. When the processor receives a HOLD request, it will drive its tri-stated pins to high impedance state at the end of current instruction execution and send an acknowledge signal to DMA controller. Now the DMA controller will perform DMA transfer.

38. What is processor cycle (Machine cycle)?

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

39. What is Instruction cycle?

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

40. What is fetch and execute cycle?

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

41.What is Block and Demand transfer mode DMA?

In Block transfer mode, the DMA controller will transfer a block of data and relieve the bus for processor. After sometime another block of data is transferred by DMA and so on.
In Demand transfer mode the DMA controller will complete the entire .data transfer at a stretch and then relieve the bus to processor.

42. What is the need for timing diagram?

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

43. How many machine cycles constitute one instruction cycle in 8085?

Each instruction of the 8085 processor consists of one to five machine cycles.

44. Define opcode and operand.

Opcode (Operation code) is the part of an instruction / directive that identifies a specific operation.
Operand is a part of an instruction / directive that represents a value on which the instruction acts.

45. What is opcode fetch cycle?

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

46. What operation is performed during first T -state of every machine cycle in 8085 ?
In 8085, during the first T -state of every machine cycle the low byte address is latched into an external latch using ALE signal.

47. Why status signals are provided in microprocessor?
The status signals can be used by the system designer to track the internal operations of the processor. Also, it can be used for memory expansion (by providing separate memory banks for program & data and selecting the bank using status signals).

48. How the 8085 processor differentiates a memory access (read/write) and 1/0 access (read/write)?
The memory access and 1/0 access is differentiated using 10 I M signal.
The 8085 processor asserts 10 I M low for memory read/write operation and 10 I M is asserted high for 1/0 read/write operation.

49. When the 8085 processor checks for an interrupt?

In the second T -state of the last machine cycle of every instruction, the 8085 processor checks whether an interrupt request is made or not.

50. What is interrupt acknowledge cycle?

The interrupt acknowledge cycle is a machine cycle executed by 8085
processor to get the address of the interrupt service routine in-order to service the interrupt device.

51. How the interrupts are affected by system reset?

Whenever the processor or system is resetted , all the interrupts except
TRAP are disabled. fu order to enable the interrupts, El instruction has to be executed after a reset.

52. What is Software interrupts?

The Software interrupts are program instructions. These instructions
are inserted at desired locations in a program. While running a program, if software interrupt instruction is encountered then the processor executes an interrupt service routine.

53. What is Hardware interrupt?

If an interrupt is initiated in a processor by an appropriate signal at the
interrupt pin, then the interrupt is called Hardware interrupt.

74. Where is the READY signal used?

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

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

76.What is Polling?

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

77. What are the different types of Polling?

The polling can be classified into software and hardware polling. In software polling the entire polling process is govern by a prograrn.1n hardware polling, the hardware takes care of checking the status of interrupting devices and allowing one by one to the processor.

78.What is the need for interrupt controller?

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

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

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

80. What is a programmable peripheral device ?

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

81. What is synchronous data transfer scheme?
For synchronous data transfer scheme, the processor does not check the readiness of the device after a command have been issued for read/write operation. fu this scheme the processor will request the device to get ready and then read/W1.ite to the device immediately after the request. In some synchronous schemes a small delay is allowed after the request.

82. What is asynchronous data transfer scheme?

In asynchronous data transfer scheme, first the processor sends a request to the device for read/write operation. Then the processor keeps on polling the status of the device. Once the device is ready, the processor execute a data transfer instruction to complete the process.

83. What are the operating modes of 8212?

The 8212 can be hardwired to work either as a latch or tri-state buffer. If mode (MD) pin is tied HIGH then it will work as a latch and so it

can be used as output port. If mode (MD) pin is tied LOW then it work as tri- state buffer and so it can be used as input port.

84. Explain the working of a handshake output port

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

85.What are the internal devices of 8255 ?

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

86. What is baud rate?
The baud rate is the rate at which the serial data are transmitted. Baud
rate is defined as l /(The time for a bit cell). In some systems one bit cell has one data bit, then the baud rate and bits/sec are same.

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

is an example of USART.

88. What are the functions performed by INTEL 8251A?
The INTEL 825lA is used for converting parallel data to serial or vice
versa. The data transmission or reception can be either asynchronously or synchronously. The 8251A can be used to interface MODEM and establish serial communication through MODEM over telephone lines.

89. 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.

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

The control words of 8251A are Mode word and Command word.
The mode word informs 8251 about the baud rate, character length, parity and stop bits. The command word can be send to enable the data transmission and reception.

91. What are the information that can be obtained from the status word of
8251 ?

The status word can be read by the CPU to check the readiness of the
transmitter or receiver and to check the character synchronization in synchronous reception. It also provides information regarding various errors in the data received. The various error conditions that can be

checked from the status word are parity error, overrun error and framing error.

92. Give some examples of input devices to microprocessor-based system.

The input devices used in the microprocessor-based system are Keyboards, DIP switches, ADC, Floppy disc, etc.

93. What are the tasks involved in keyboard interface?

The task involved in keyboard interfacing are sensing a key actuation, Debouncing the key and Generating key codes (Decoding the key). These task are performed software if the keyboard is interfaced through ports and they are performed by hardware if the keyboard is interfaced through 8279.

94. How a keyboard matrix is formed in keyboard interface using 8279?

The return lines, RLo to RL7 of 8279 are used to form the columns of keyboard matrix. In decoded scan the scan lines SLo to SL3 of 8279 are used to form the rows of keyboard matrix. In encoded scan mode, the output lines of external decoder are used as rows of keyboard matrix.

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

The process of sending a zero to each row of a keyboard matrix and reading the columns for key actuation is called scanning. The scan time

is the time taken by the processor to scan all the rows one by one starting from first row and coming back to the first row again.

96. What is scanning in display and what is the scan time?

In display devices, the process of sending display codes to 7 -segment LEDs to display the LEDs one by one is called scanning ( or multiplexed display). The scan time is the time taken to display all the 7-segment LEDs one by one, starting from first LED and coming back to the first LED again.

97. What are the internal devices of a typical DAC?

The internal devices of a DAC are R/2R resistive network, an internal latch and current to voltage converting amplifier.

98. What is settling or conversion time in DAC?

The time taken by the DAC to convert a given digital data to corresponding analog signal is called conversion time.

99. What are the different types of ADC?

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

100. Define stack
Stack is a sequence of RAM memory locations defined by the programmer.
101. What is program counter? How is it useful in program execution?

The program counter keeps track of program execution. To execute a program the starting address of the program is loaded in program counter. The PC sends out an address to fetch a byte of instruction from memory and increments its content automatically.

102. 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.

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Roll No. _____ Total No of Pages: 2

# 4E1220

## B. Tech. IV-Sem. (Back) Exam., Oct.-Nov. - 2020

## Electronics & Communication Engineering

## 4EC4 - 05 Microcontrollers

## EC, EI

**Time: 2 Hours** **Maximum Marks: 82**

**Min. Passing Marks: 29**

*Instructions to Candidates:*

***Attempt all ten questions from Part A, four questions out of seven questions from Part B and two questions out of five from Part C.***

*Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.*

*Use of following supporting material is permitted during examination. (Mentioned in form No. 205)*

1. NIL 2. NIL

## PART – A

**(Answer should be given up to 25 words only)** **[10×2=20]**

**All questions are compulsory**

Q.1 Name three features of the 8051.

Q.2 What is the major difference between the 8051 and 8052 microcontrollers?

Q.3 What is the size of the SP register?

Q.4 How does an instruction differ from a directive?

Q.5 Which program produces the "Obj" file?

Q.6 Why do we need subroutines?

Q.7 When LCALL is executed? How many bytes of the stack are used?

Q.8 Define Cache memory.

Q.9 Which pins are assigned to $V_{cc}$ and GND?

Q.10 What is the error in the following instruction- MOV A, @R2?

## PART – B

**(Analytical/Problem solving questions)** **[4×8=32]**

**Attempt any four questions**

Q.1 Show how to put value 99H into RAM location F6H of upper RAM in the 8052?

Q.2 Show how would you check whether the P flag is high?

Q.3 Which version of the 8051 does not have on-chip ROM? How many parallel and serial port lines the 8051 has?

Q.4 Examining the stack, show the contents of the registers and SP after execution of the following instructions. All values are in hex.

```
POP 3  ; POP stack  into  R3
POP 5  ; POP stack  into  R5
POP 2  ; POP stack  into  R2
```

Q.5 Discuss the role (need) of timers in microcontrollers.

Q.6 What do you mean by Arithmetic Coprocessors?

Q.7 Multiply 25 by 10 using the technique of repeated addition.

## PART – C

**(Descriptive/Analytical/Problem Solving/Design Questions)** **[2×15=30]**

**Attempt any two questions**

Q.1 Name and explain the working of all instructions available in 8051 assembly language.

Q.2 Draw and explain block diagram of 8051 microcontroller.

Q.3 Discuss ARM microcontrollers interface designs with suitable diagram.

Q.4 Explain the working of A/D and D/A converters.

Q.5 Define Interrupts. Give the role of interrupts in programming of microcontrollers. Give suitable example in support of your answer.

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Roll No. _____ Total No of Pages: 3

# 4E1220

## B. Tech. IV-Sem. (Main) May 2019
## PCC Electronics & Comm. Engg.
## 4EC4-05 Microcontrollers
## EC, EI

**Time: 3 Hours** **Maximum Marks: 120**

*Instructions to Candidates:*

***Attempt all ten questions from Part A, five questions out of seven questions from Part B and four questions out of five from Part C.***

*Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.*

*Use of following supporting material is permitted during examination. (Mentioned in form No. 205)*

1. NIL 2. NIL

## PART – A

**(Answer should be given up to 25 words only)** **[10×2=20]**

**All questions are compulsory**

Q.1 How many different buses are used 8085 microprocessor?

Q.2 How many hardware interrupts are used in 8085 microprocessor?

Q.3 Explain the LXI Rp, 16 bit data and DAA instructions.

Q.4 What is the use of ALE pin?

Q.5 Why $AD_0$ - $AD_7$ line are multiplexed?

Q.6 Why cache memory is required?

Q.7 How many chips are required to make 2 kB of memory with the help of 256 × 4 bit memory chip?

Q.8 What are Maskable and Non-Maskable interrupt?

Q.9 Write and explain in short one application of 8051 microcontroller and 8085 microprocessor each. 

Q.10 Give names of addressing modes of 8085 microprocessors.

## PART – B

**(Analytical/Problem solving questions)** **[5×8=40]**

**Attempt any five questions**

Q.1 Draw the architecture diagram of 8085 microprocessor.

Q.2 Draw the PIN diagram of 8051 microcontroller and explain the following PINS-

(i) External enable

(ii) PSEN

(iii) Read strobe ($\overline{RD}$)

Q.3 Write the program to add two 16 bit numbers with carry.

Q.4 Write a program to find out the largest number among the array of five numbers.

Q.5 Give the classification of interrupts and explain for 8085 microprocessors.

Q.6 Explain the concept of D/A converter.

Q.7 What is the timer in 8085 microprocessor?

# PART – C

(Descriptive/Analytical/Problem Solving/Design Questions) [4×15=60]

**Attempt any four questions**

Q.1 Explain the DMA 8257 controller in detail.

Q.2 How instruction sets are classified in 8085 microprocessor? Explain with example of each classification.

Q.3 Discuss in detail RISC architecture.

Q.4 Write a program to find out the factorial of four in 8085 microprocessor.

Q.5 Explain ARM microcontroller interface design.

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6E6052

Roll No. : 15EEBEC036

Total Printed Pages : 3

# 6E6052

**B. Tech. (Sem. VI) (Main / Back) Examination, April-May 2018**
**Electronics & Communication Engg.**
**6EC2A Microprocessors**

**Time : 3 Hours**

**Maximum Marks : 80**
**Min. Passing Marks : 26**

*Attempt any **five questions**, selecting **one question** from **each unit**. All Questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used / calculated must be stated clearly.*

*Use of following supporting material is permitted during examination. (Mentioned in form No. 205)*

1. NIL 2. NIL

## UNIT - I

1 (a) Draw the architecture diagram of 8085 microprocessor and explain function of various register. **8**

(b) State the differences between static and dynamic RAM. **8**

**OR**

1 (a) Why are $AD_0$–$AD_7$ lines are multiplexed ? With the help of latching ckt., explain how these lines are demultiplexed. **8**

(b) Explain various addressing mode in 8085 Microprocessor with example. Also explain the Instruction format. **8**

## UNIT - II

2 (a) Write a program to load the data byte 8EH in register D and F7H in register E. Mask the high order bits ($D_4$–$D_7$) from both the data bytes, EX-OR the low order bits ($D_0$–$D_3$) and display the result and also draw the flow chart.

**8**

(b) Explain the following instruction of 8085 Microprocessor :

(i) LHLD
(ii) XTHL
(iii) DAA
(iv) STAXB

**2×4=8**

**OR**

2 (a) Write an assembly language program to add the following five data bytes stored in memory location starting at 2060 H. If the sum generates carry stop the addition and display O/H at the output port; otherwise continue adding the display the sum
Data : 98H, A2H, 39H, 22H, 42H

**8**

(b) What are subroutines ? How they are useful ?

**8**

## UNIT - III

3 (a) What do you mean by a Machine Cycle and T States ? What are basic machine cycle of 8085 microprocessor with their status signals ?

**12**

(b) Find the maximum time delay which can be provided using one 8 bit register. The operating frequency of microprocessor is 2 MHz.

**4**

**OR**

3 (a) Draw the timing diagram of following instruction and also explain the same.
MVI B, 2EH

(b) Explain Digital to Analog Converters.

**8**

## UNIT - IV

4 (a) What do you mean by Masking of interrupts ? Explain SIM instruction. 8

(b) Explain the interrupt structure of 8085, then describe the important PIN signal and instruction involved in handling the interrupt. 8

**OR**

4 (a) Explain data Synchronous and Asynchronous transmission in 8085 Microprocessor. 8

(b) Write short note on serial I/O standards. 8

## UNIT - V

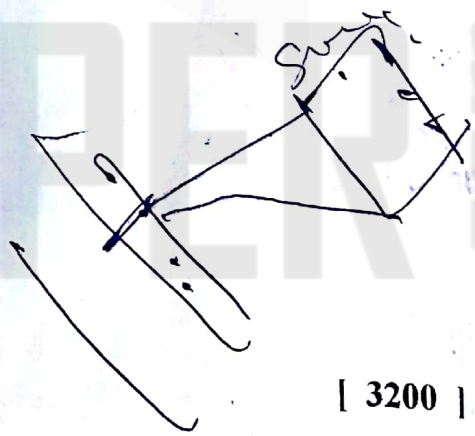
5 (a) Draw and explain the block diagram of DMA controller. 8

(b) Draw the functional block dig. of 8254 IC and explain various operating mode. 8

**OR**

5 (a) List the major components of 8279 key board/display controller and explain their function. 8

(b) Explain operating mode of 8255 programmable peripheral interface. 8



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**B.Tech. VI Semester (Main/Back) Examination, April/May - 2017**

**Electronics & Communication Engg.**

**6EC2A Microprocessors**

**Time : 3 Hours** **Maximum Marks : 80**

**Min. Passing Marks : 26**

***Instructions to Candidates:***

*Attempt any **five questions**, selecting **one question** from **each unit**. All Questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitable be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

**Unit - I**

1. Draw and explain the block diagram as well as pin diagram of 8085 microprocessor. **(16)**

**OR**

1. State and explain the various types of addressing modes available in 8085. **(16)**

**Unit - II**

2. State and explain the conditional call and return instructions of 8085 along with suitable examples. **(16)**

**OR**

2. State the various data transfer instructions of 8085. Explain them with suitable examples. **(16)**

**Unit - III**

3. Explain the arithmetic operations related to memory counter and time delays. **(16)**

**OR**

3. Explain the 16 bit data operations and arithmetic instructions. **(16)**

## Unit - IV

4. What are vector interrupts? State and explain them. **(16)**

**OR**

4. State an explain the interrupts for serial I/O and data communication. **(16)**

## Unit - V

5. Explain the programmable peripheral devices, along with the pin and block diagram of 8255 PPI. **(16)**

**OR**

5. Write short notes on : **(8 × 2 = 16)**

   i) DMA controller.

   ii) Interval timer.

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