S'11:6 AN:CP 425/EL 415/425/ 435/EC 405(1460)

MICROPROCESSORS AND MICROCONTROLLERS

Time : Three hours

Maximum Marks : 100

Answer FIVE questions, taking ANY TWO from Group A, ANY TWO from Group B and ALL from Group C.

All parts of a question ( a, b, etc.) should be answered at one place.

Answer should be brief and to-the-point and be supplemented with neat sketches. Unnecessary long answers may result in loss of marks.

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Figures on the right-hand side margin indicate full marks.

Group A

1. (a) Explain the following with suitable examples : 3 x 2

   (i) Initialization of the stack memory

   (ii) Saving the contents of register pair BC into stack memory

   (iii) Restoring the contents of BC register pair

   (b) Draw the functional block diagram of 8085 microprocessor and discuss its operation. 8

   (c) A set of three readings is stored in memory starting

   ( Turn Over )
2. (a) Discuss, with suitable examples, various priority modes of programmable interrupt controller 8259A.

(b) What do you understand by vectored interrupts of 8085 microprocessor? State the priorities and explain.

(c) Distinguish between volatile and non-volatile memory.

3. (a) Explain the following addressing modes with suitable examples:

(i) Direct addressing mode
(ii) Register indirect addressing mode
(iii) Immediate addressing mode
(iv) Indirect addressing mode

(b) Explain the operation of following instructions with suitable examples:

(t) SOD, (ii) S and Sp, (iii) READY, (iv) SID

(c) Discuss the following modes of DMA transfer with a suitable example:

(i) Signal transfer mode
(ii) Block transfer mode
(iii) Demand transfer mode
(iv) Memory-to-memory transfer mode

4. (a) Interface IC 8255 to microprocessor 8085 with port A address 95H and write a program in BSR mode to generate 100 pulses at the rate of 200 Hz and duty cycle 40%.

(b) Distinguish between memory mapped I/O and I/O mapped I/O.

(c) What will be the output of the following program?

(i) MOV A, 50H
(ii) ORA A
(iii) PUSH PSW
(iv) HLT

Group B

5. (a) Draw and discuss the internal architecture of 8051 microcontroller.

(b) Discuss the formats of PSW register of 8051 microcontroller.

6. (a) Five bytes are stored at external data RAM from address 1000H. Store these data in internal RAM from starting address 400H.

(b) Explain the following pins of 8051 microcontroller with an example:

(i) TXD, (ii) RXD, (iii) PSEN, (iv) EA

(c) Describe the data storage scheme in a stack structure in 8051 microcontroller.

7. (a) Explain the TMOD and TCON registers of 8051 microcontroller.

(b) Write a program to generate a square wave of frequency 2 kHz through port P1.0 by timer 0 of 8051 microcontroller.

(c) Explain the difference between forward jump and backward jump.
8. (a) Draw and explain the internal RAM structure of 8051 microcontroller.

(b) Explain the following instructions:

(i) MOV A, #56H
(ii) MOVCA, @A+DPTR
(iii) DEC @R1
(iv) DJNZ R0 BACK

(c) Explain the interrupt vector table of 8051 microcontroller.

9. (A) Choose most appropriate answer and suggest the correct answer if options are not given for the following questions:

(i) When a subroutine is called, the address of the instruction following the CALL instruction is stored on the———.
   (a) stack pointer. (b) accumulator. (c) program counter. (d) stack.

(ii) Time required to complete the execution of an instruction is defined as———.
   (a) machine cycle (b) instruction cycle (c) T state.

(iii) What is the clock frequency of 8085 microprocessor?

(iv)——— interrupt is the non-maskable and having the highest priority.

(v)——— signal is used to separate the multiplexed address and data lines.

(vi) LDA is——— byte instruction.

(vii) A stack pointer is——— bit register in microprocessor 8085.

(viii) Specify the restart memory location when the microprocessor is interrupted.

(B) Answer the following in brief:

(i) Assume accumulator contents are AA(H) and CY = 0. Illustrate the accumulator contents after the execution of RLC instruction twice.

(ii) Distinguish between SIM and RIM instruction.

(iii) Load F2(H) directly in memory location 8000H using indirect addressing.

(iv) List four categories of 8085 instructions that manipulate data.

(v) Load the accumulator A with data byte 82(H) and save the data in register B.

(vi) List the name of analog-to-digital converters and digital-to-analog converters.
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Group A

1. (a) Explain the architecture of 8085 with a neat block
diagram. 8

(b) Two switches, SW 1 and SW 2, are connected to
port A pins of 8255 and two LEDs are connected
to port B of 8255. Write an assembly language
program to check the status of the switches and
make the LEDs glow accordingly (i) if SW 1 alone
is ON, make both the LEDs ON and OFF conti-
uously with a delay; (ii) if SW 1 and SW 2 are
ON, make any one LED ON and OFF conti-
uously with a delay; and (iii) give the circuit dia-
gram. 5 + 5 + 2
2. Explain the following 8085-based assembly language instructions:
   
   LHD 2500
   DAA
   STAX B
   PUSH H
   XTHL
   OUT PORT
   STA 4500
   CALL 2000
   XCHG
   DAD D

   10 × 2

3. (a) Give the interface diagram of 8085 with a DAC and write an assembly language program to generate a sawtooth and rectangular waveform.  
   
   (b) Write a short note on DMA transfer of data.  

4. (a) Give the architecture of 8253 with a neat diagram and control word format.  
   
   (b) Write an assembly language program using 8085 to generate a square waveform using 8253.  

   Group B

5. (a) Explain the architecture of 8051 microcontroller with a neat block diagram.  
   
   (b) Write an assembly language program using 8051 to generate a sawtooth and square waveform using the general purpose ports of 8051.  

6. (a) Discuss the differences of 8085, 8031 and 8051.  

   (b) Explain the instructions to access external RAM and external ROM.  

   (c) Draw and explain the timer structure of 8051 with its relevant registers.  

7. (a) Draw the memory map for 128 byte internal RAM of 8051.  

   (b) Write an assembly language program using 8051 to access the 7 segment code of a number which is stored in ROM. Store 7 segment codes of 0-9.  

8. (a) Explain how a d.c. motor can be controlled in its speed using 8051 microcontroller. Give the interface diagram and the program.  

   (b) Explain any five arithmetic instructions of 8051.  

   Group C

9. Answer the following in brief:  

   (i) What is the result of instruction XRA A?  
   (ii) What is the size of internal ROM in 8051?  
   (iii) If a 8-bit DAC gives output from 0-5 V, what value should be given as input to generate 2.5 V?  
   (iv) Differentiate between assembler and simulator.  
   (v) What is the purpose of ALE signal in any processor?  
   (vi) What is the purpose of HOLD signal in 8085?  
   (vii) Define RST 1 instruction in 8085.  
   (viii) Find the LSB for an 8 bit DAC of range 0-10 V.  
   (ix) Which register in 8085 gives the size of the address bus in 8085?  
   (x) What is an emulator?
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MICROPROCESSORS AND MICROCONTROLLERS

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Group A

1. (a) Explain the following with suitable examples for 8085 microprocessor:
   3 x 2
   (i) Addition of two words
   (ii) Exchanging the contents of HL and DE pairs
   (iii) Restoring the contents of flag register from stack

   (b) Discuss the functions of pins of 8085 microprocessor.

   (c) A set of four bytes is stored in consecutive memory locations starting from 8100H. Write 8085 based assembly language program to find the minimum. Data (H) are: F2, 05, 42, 35.

   (Turn Over)
2. (a) Discuss how vector interrupts of 8085 microprocessor are triggered, enabled and masked. How are the vector locations computed? \[ 8 + 2 \]

(b) Draw the functional block diagram of programmable interrupt controller 8259A and discuss its operation in conjunction with 8085 microprocessor. \[ 10 \]

3. (a) Explain the operations of following instructions of 8085 microprocessor: (i) PCHL, (ii) XTHL, (iii) DAA, (iv) LHLD 8000H, (v) ADC M, (vi) RST 7, (vii) RET, (viii) MVI M, 42H, (ix) STAX B, (x) XRA A. \[ 10 \]

(b) Discuss how DMA controller can work with 8085 microprocessor. Draw a suitable diagram to explain the whole operation. Assume transfer of data is occurring from memory to an I/O device. \[ 5 + 3 + 2 \]

4. (a) Draw the functional diagram of 8253 programmable counter timer. Discuss its different modes of operation. Also, discuss its control word. \[ 10 \]

(b) How can a rectangular wave be generated by 8085 microprocessor without using any interfacing device? Explain with the help of a program. Use delay program written with the help of HL.pair. \[ 4 \]

(c) Draw a diagram consisting of an ADC, 8255A PPI ports, 8085 microprocessor, and sample and hold chip LF 398. Explain the operation how an analog data is converted into a digital byte. \[ 6 \]

5. (a) Draw and discuss the internal architecture of 8051 controller. \[ 10 \]

(b) Discuss the pins of the same. \[ 6 \]

(c) How can bank 1 registers be worked with? \[ 4 \]

6. (a) Four bytes are stored at external data RAM from address 4200H. Write 8051 based program for cumulative addition of these four data. Internal RAM locations are not to be used. Data (H) are: 2F, 4C, 35, 22. \[ 12 \]

(b) Explain the following SFRs of 8051 microcontroller: (i) TMOD, (ii) TCON, (iii) IE, (iv) SCON. \[ 4 \]

7. (a) Write a 8051 based delay program using four bank \( \phi \) registers. \[ 6 \]

(b) Write a program to generate a square wave of 50 Hz through port P1.2 by timer 1 of 8051 microcontroller. \[ 8 \]

(c) Draw and explain the internal RAM (from OOH to 7FH) of 8051 microcontroller. \[ 6 \]

8. (a) Write four instructions for each data transfer group, arithmetic group, logical group and branch group. \[ 4 \]

(b) Explain the interrupt vector table of 8051 controller. \[ 4 \]
Group C

9. (A) Choose most appropriate answer and suggest the correct answer, if options are not given for the following questions: 10 x 1

(i) What is the clock frequency of 8051 microcontroller?

(ii) — interrupt is the maskable and having the lowest priority.
   (a) RST 7.5  (b) TRAP

(iii) — trigger signal to activate RST 7.5 interrupt.

(iv) — number of machine cycles are required after the FETCH machine cycle for any 8051 based instruction.
   (a) Four  (b) Five  (c) Six  (d) Two

(v) — signal is used to demultiplex the multiplexed address and data bus in case of 8051.

(vi) — instruction pops out the return address in the main program.

(vii) Fill up the blank in the instruction.
      DJNZ ———, LABEL.

(viii) Fill up the blank in the instruction.
       CJNE A_, ———, LABEL.

(ix) The port P4 is a ——— register and ——— addressable.

(x) In external RAM interfacing, P6 acts as a ——— multiplexed bus, whereas P2 acts as ——— bus.

(B) Answer the following in brief:

(i) Assume accumulator contents are 6B (H) and CY = 1. Illustrate the accumulator contents after the execution of RAR instruction twice.

(ii) Distinguish between direct register addressing mode and indirect register addressing mode by suitable examples for 8051 microcontroller.

(iii) Give two bit manipulating instructions of 8051 microcontroller.

(iv) Write a simple program for generating a sawtooth waveform with the help of 8051 controller and DAC interfaced to P4 port of 8051.

(v) What is the control word of 8255A PPI for the following configuration:
   Port A as input port, Port B as output port, Port C upper as input port and Port C lower as output port, Mode 0 configuration.
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MICROPROCESSORS AND MICROCONTROLLERS

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Group A

1. (a) Name the control signal pins of 8085 microprocessor and explain the use of each signal pin. 10

(b) Explain how a RAM chip (1k × 8) can be interfaced to 8085 microprocessor with the help of a diagram. 10

2. (a) Name the four segments of memory with which 8086 microprocessor work at a time. Also, explain how 8086 microprocessor access a particular location within the selected segment. 10

(b) Discuss about the interrupt structure of 8085 microprocessor. 10
3. (a) Draw the internal architecture of 8255 programmable peripheral interface chip in a block diagram form and explain.

(b) Explain how the microprocessor identifies the activated key in a matrix keypad and generates the corresponding hex code of the activated key using the row scanning method.

4. (a) Name and explain the different addressing modes supported by 8085 instruction with an example.

(b) Write an assembly level program using 8085 instructions to add an array of unsigned binary numbers. The array length is specified in memory location 1002 h. The array starts from 1003 h. Save the results in locations 1000 h and 1001 h.

Group B

5. (a) Draw the internal architecture of 8051 microcontroller in a block diagram form and explain the function of each block.

(b) Explain the memory map of the internal 128 byte RAM of the 8051 microcontroller.

6. (a) Name the alternate use of pins 3 of the microcontroller 8051.

(b) List and explain different modes of operation of the timer of 8051 microcontroller.

7. (a) List the programming steps needed to receive data serially using 8051 microcontroller and explain.

(b) Write an assembly language program using 8051 microcontroller instructions to generate a square wave at port 1, pin 0 (i.e., P1.0). The frequency of the generated square wave is to be 1 kHz.

8. (a) Explain the operation of the following instructions of 8051 microcontroller: (i) SWAP A, (ii) MOV A @ R1, (iii) MOV A @ R0, (iv) DNNZ R0, TABLE, (v) SETB P1.3.

(b) Name five interrupt sources of 8051 microcontroller and specify their respective vector address and their priority level after reset. Also, explain how the interrupts can be enabled or disabled.

Group C

9. Answer the following in brief:

(i) State a single instruction of 8085 microprocessor which can give a left shift to the content of H-L pair register.

(ii) Differentiate between memory mapped I/O and I/O mapped I/O.

(iii) List the main functions of the BIU (Bus Interface Unit) of 8086 processor.

(iv) Why is it not possible to use JUMP address instruction to call a subroutine program?

(v) How many programmable interrupt controller (8259) ICs are required to provide interrupt request input to 58 different devices? State the number of master 8259 and slave 8259 required.

(vi) How many register banks are there in 8051 internal RAM? How to select the desired bank?

(vii) In 8051 microcontroller, the crystal oscillator frequency is 11.0592 MHz. Find the machine cycle frequency.
(viii) State the difference between overflow flag (ov) and carry flag (cy).

(ix) To interface external memory to 8051, how are the address, data and control bus signals obtained?

(x) Discuss the role of PSEN pin in 8051 microcontroller.
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Group A

1. (a) Discuss the operations of HOLD and HLDA signals and INTR and INTA signals of 8085 microprocessor in conjunction with proper programmable peripheral devices. 10

   (b) Explain the comparative features of memory-mapped I/O and I/O mapped I/O interfacing to 8085 microprocessor along with its proper control signals required. 10

2. (a) Draw and explain the complete functional block diagram of 8086 microprocessor. Also, explain the computation of actual physical address of 20 bits. 10

   (b) Discuss about the interrupt structure of 8085 microprocessor along with SIM and RIM instructions. 10
3. (a) Discuss the internal functional block diagram of 8253 programmable counter timer and explain its control word also.  

(b) Explain, with a proper diagram and assembly language program, how analog-to-digital conversion operation can be implemented with the help of 8085 microprocessor using asynchronous mode of data transfer and 8255 programmable peripheral interface chip and an ADC chip.  

4. (a) Draw and explain the internal architecture of 8259 programmable interrupt controller. Explain its all control words also.  

(b) Write an assembly language program how sinusoidal and triangular waveforms can be generated by a digital-to-analog converter using 8085 microprocessor and 8255 PPI chip and a DAC chip.  

**Group B**  

5. (a) Draw and explain the internal block diagram and the names of all pins of 8051 microcontroller.  

(b) Explain the memory map of the internal 128 byte RAM and special function registers of the 8051 microcontroller.  

6. (a) Discuss the alternate uses of port $\phi$ and port 2 of the 8051 microcontroller along with proper assembly language instructions and control signals.  

(b) Explain different types of instruction groups with the help of at least two assembly language instructions for 8051 microcontroller.  

7. (a) Write an assembly language program using 8051 microcontroller instructions to generate a 50 Hz square wave at port $\phi$, pin 6 (i.e., p$\phi$.6).  

**Group C**  

8. (a) Discuss the uses of pins of port 3 of the 8051 microcontroller.  

(b) Name the interrupt sources of 8051 microcontroller and specify their respective vector addresses and priority levels after reset. Also, explain how the interrupts can be enabled or disabled.  

(c) Discuss in brief stack and stack operations of the 8051 microcontroller.  

9. Answer the following in brief:  

(i) State a single byte instruction of 8051 microprocessor which can reset both accumulator and carry bit.  

(ii) What is the function of ALE signal pin along with port $\phi$ pins of 8051 microcontroller?  

(iii) How can you generate MR, MW, IOR and IOW control signals in 8051 microprocessor?  

(iv) What are the stack operations involved in CALL and RET instructions in 8051 microprocessor?  

(v) How can you select a particular register bank, for example, R2 of 8051 microcontroller?  

(vi) Explain the operation of CJNE instruction of 8051 microcontroller.  

(vii) How many machine cycles and T states and how much time required for executing the instruction DJNZ R,y, TABLE for 8051 microcontroller operating at 11.0592 MHz crystal oscillator frequency.
(viii) Discuss the DAA instruction operation of 8085 microprocessor.

(ix) What are four different types of data transfer supported by 8085 microprocessor?

(x) What is the highest delay parameter when 8085 microprocessor executes a software delay program using decrementing operation of a register?
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Group A

1. (a) Explain the architecture of 8085 with a neat block diagram. 10

(b) Give the interfacing diagram to interface 8085 with 1 K RAM and 1 K ROM. Give the address map. 10

2. (a) Differentiate between I/O mapped I/O and memory mapped I/O in 8085. 5

(b) List different hardware and software and interrupts of 8085 and mention its purpose. 8

(c) Explain the concept of DMA with a neat diagram. 7
3. (a) Explain the functioning of 8251 USART with a neat block diagram and the control words.  
(b) Write an assembly language program to interface 8255 to an LED and a switch. If the switch is on, the LED should blink, otherwise the LED should be off.  

4. (a) Write short notes on ‘assemblers’ and ‘emulators’.  
(b) Give the interface diagram of connecting an 8 bit DAC to the microprocessor (8085). Write an assembly language program to generate a square wave.  
(c) Explain the operation of the following instructions:  

<table>
<thead>
<tr>
<th>Instruction</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LHLD 2000</td>
<td></td>
</tr>
<tr>
<td>XCH G</td>
<td></td>
</tr>
<tr>
<td>DAD H</td>
<td></td>
</tr>
<tr>
<td>DAA</td>
<td></td>
</tr>
<tr>
<td>XRA A</td>
<td></td>
</tr>
</tbody>
</table>

5. (a) Draw the block diagram of 8051 and explain its functions.  
(b) List various registers of 8051 and mention the purpose of each register.  

6. (a) Discuss different modes of operation of the serial interface of 8051.  
(b) Write an assembly language program in 8051 to measure the pulse width of any signal using in-built timer.  

7. (a) Explain the operation of the following instructions with examples:  

<table>
<thead>
<tr>
<th>Instruction</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOVCA, @A + DPTR</td>
<td></td>
</tr>
</tbody>
</table>

(ii) XCHDA, @RO  
(iii) MOV C, P3.1  
(iv) SWAP A  
(v) RR A  

(b) An array of 10 numbers is stored in the internal data RAM starting from location 30 H. Write an assembly language program to move the array starting from location 40 H.  

8. (a) Discuss the interrupt sources of 8051, their vector locations and different control bits used to control all the interrupts.  
(b) Design a microcontroller based system to measure the temperature in an industry and to generate an alarm when the temperature limit is exceeded. Write the algorithm for the program.  

9. Answer the following in brief:  

(i) Why is a crystal preferred clock source?  
(ii) What is the type of stack used in 8085?  
(iii) Why is 8085 processor called as an 8 bit processor – justify.  
(iv) How many I/Os can be connected to 8255?  
(v) Why are program counter and stack pointer 16 bit registers?  
(vi) Give the formula to calculate baud rate for serial port in macro.  
(vii) Write a program to find 2s complement using 8051.  

Group C
(viii) Mention the alternative function of P3.1 and P3.5.

(ix) If a register contains the value OF, what will be the value after the instruction SWAP A?

(x) Differentiate between 8031 and 8051 microprocessors. How do you identify the IC visually, if the IC numbers are erased?
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Group A

1. (a) Explain the 2s compliment method with an example. 5
   (b) Explain the action of applying RESET to the CPU. 5
   (c) Explain the hardware interrupts available in 8085. 10

2. (a) Discuss the architecture of 8085 microprocessor with a neat diagram. 10
   (b) Using a software interrupt, write the main program to call a time delay program as an interrupt service routine. 5
   (c) Write the procedure to mask the RST 6.5 interrupt. 5
3. (a) Explain the concept of debugger in detail. 5
(b) Explain the block schematic of 8259 programmable interrupt controller in detail. 10
(c) Differentiate between ADC and DAC. 5

4. (a) Enumerate and explain any two potential applications of microprocessor. 5
(b) Explain the concept of internal and external memory. 5
Distinguish between static and dynamic memory. 5 + 5
(c) Differentiate between 8-bit and 16-bit microprocessors. 5

**Group B**

5. (a) What is the difference between microprocessor and microcontroller? Explain. 5
(b) Draw the architecture of 8051 microcontroller and explain it in detail. 10
(c) Compare and contrast different microcontrollers. 5

6. (a) Explain in detail the 8051 registers. 5
(b) Discuss in detail the 8051 interrupts. 10
(c) Explain the power-driven modes in 8051. 5

7. (a) Explain the instruction sets of 8051 in detail. 10
(b) Discuss in detail the 16-bit registers of DPTR and SP of 8051. 5
(c) Explain in detail five interrupt sources of 8051. 5

8. Write short notes on the following: 5 + 10 + 5
(a) Assemblers and cross-assemblers
(b) Interfacing a stepper motor with the microprocessor kit
(c) Programming of IC 8279.

**Group C**

9. Answer the following in brief: 10 × 2
(i) What is the drawback in machine language and assembly language programs?
(ii) What are the modes in which 8086 can operate?
(iii) Write the flags of 8086.
(iv) What is pipeline architecture?
(v) Whether HOLD has higher priority than TRAP or not?
(vi) Write a program to mark the 19th and 7th bits using 8051 microprocessor.
(vii) What are different types of polling?
(viii) Where is the ‘Ready’ signal used?
(ix) What are the schemes for establishing priority in order to resolve bus arbitration problem?
(x) What is the sine of ports in 8255?
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Group A

1. (a) Draw and explain the functional block diagram of 8085 microprocessor. 10

   (b) Write the comparative features of memory mapped I/O and I/O mapped I/O. Mention the control signals and how they are generated for both the cases. 5 + 5

2. (a) Give the interfacing diagram to interface 8085 with one 4K RAM, one 4K EPROM, one PPI (8255A) and one PTC (8253) in memory mapped I/O mode. 10

   (b) Give the similar interfacing diagram, keeping the same peripherals in I/O mapped I/O mode. Also, generate proper control signals. 10

3. (a) Explain 8085 instructions ‘SIM’, ‘EI’, ‘DI’ and ‘RIM’ in connection with the internal circuit diagram
for 8085 interrupts. Also, draw the internal circuit diagram neatly.

(b) Explain the concept of DMA with a neat diagram. Describe functions of the pins of 8257 DMA controller.

4. (a) Draw and explain the interface diagram of connecting an 8 bit 8-channel ADC 0809 to the microprocessor (8085). Draw necessary waveforms and write an assembly language program to convert an analog signal data into digital data.

(b) How do you generate a sinusoidal waveform with the help of 8085 microprocessor and necessary interfacing devices? Also, write the necessary assembly language program.

Group B

5. (a) Draw and explain the pin out diagram of 8051 microcontroller.

(b) List all registers of 8051 microcontroller and mention the purpose of each register.

6. (a) Write an assembly language program in 8085 to produce a rectangular waveform through a port pin. Give necessary software delays using three registers \( R_2, R_3, \) and \( R_4 \) for high and low periods. Low period is assumed to be much larger than high period.

(b) Explain the formats of TMOD and TCON special purpose registers of 8051 microcontroller.

7. (a) Explain the operations of following instructions:

(i) CJNE A, # data, LABEL 1

(ii) DJNZ R0, LABEL 2

(iii) RL A

(iv) DA A

(v) MOVX @DPTR, A

(b) Assume that bit P.2.3 is an input and represents the condition of a door. If it goes high, it means that the door is open. Monitor the bit continuously. Whenever it goes high, send a low-to-high pulse to port P1.5 to turn on a buzzer. Figure 1 shows the scheme.

6051
8051
P 2.3
P 1.5

Buzzer

$V_{cc}$

4.7 K

7404

hex inverter

Fig. 1

Write a suitable 8051 based assembly language program.

8. (a) Write an assembly language program of 8051 for producing binary image of a 8 bit binary data.

(b) Design 8051 based stepper motor speed control. Write the assembly language program.

Group C

9. Answer the following in brief:

(i) What is the operating clock frequency of 8051 normally used?
(ii) Which register in 8051 does act as a stack by default?

(iii) How many interrupting devices can be connected to programmable interrupt controller 8259?

(iv) What is the difference in operation of stack pointers of 8085 microprocessor and 8051 microcontroller?

(v) Which instruction can be used for WORD addition in 8085?

(vi) What is the difference in hardware between P0 port and P1 port of 8051 microcontroller.

(vii) What is the function of ALE signal in 8085 microprocessor?

(viii) How can you switch from bank 0 registers to bank 2 registers in 8051 microcontroller?

(ix) How can you make P0 port of 8051 microcontroller as an input port?

(x) What are the alternative functions of P0 and P2 ports of 8051 microcontroller?
S'15 : 6 AN : CP 425/EL 415/425/435/EC 405 (1460)

MICROPROCESSORS AND MICROCONTROLLERS

Time : Three hours

Maximum Marks : 100

Answer five questions, taking any two from Group A, any two from Group B and all from Group C.

All parts of a question (a, b, etc.) should be answered at one place.

Answer should be brief and to-the-point and be supplemented with neat sketches. Unnecessary long answer may result in loss of marks.

Any missing or wrong data may be assumed suitably giving proper justification.

Figures on the right-hand side margin indicate full marks.

Group A

1. (a) Describe the programming model of 8085 microprocessor with a neat diagram. 5

   (b) Explain the pin diagram of 8085 microprocessor with a neat sketch. 10

   (c) Explain the role of following in microprocessor :

       (i) Accumulator 5 × 1

       (ii) ALE

       (iii) Ready signal

       (iv) Program counter
2. (a) Differentiate between 8 bit and 16 bit processors. Explain the difference. 4
(b) Why are address and data lines multiplexed? Explain how these lines are demultiplexed. 6
(c) Write an assembly language program to add two 8-bit numbers and use the unconditional jump in this program. 10

3. (a) Write an assembly language program to add two 8-bit numbers stored in A & B and use the RST 1 instead of HLT to terminate the program. 8
(b) Describe programmable interval timer and programmable interrupt controller with diagrams. 8
(c) Differentiate ADC from DAC. 4

4. (a) Describe Direct Memory Access Controller with a diagram. 7
(b) Draw the pin diagram of 8279 and explain in detail. 7
(c) Write short notes on the following: 3 x 2
   (i) Cross assembler
   (ii) Concept of debugger
   (iii) DMA

Group B

5. (a) Explain the features of microcontrollers. Compare and contrast different microcontrollers. 6
(b) Draw the internal architecture of 8051 and briefly explain. 8

(c) Describe the interrupt system of microcontroller with a neat diagram. 6

6. (a) What are the significance of DPTR and EA pin? Explain. 6
(b) Explain the architecture of 8051 microcontroller with a diagram. 8
(c) Draw the program memory organization in 8051 and explain. 6

7. (a) State and explain the functions of RS 1 and RS 0 bits in the flag register of 8051. 6
(b) List and explain the addressing modes of 8051. 8
(c) Explain why SJMP instruction is used in the place of HLT in 8051 with an example. 6

8. (a) Explain the operation of CJNE and DJNZ instructions. 6
(b) Justify why the crystal oscillator frequency in 8051 is chosen as 11.0592 MHz. 6
(c) Write a program using 8051 assembly language to change the data 55H stored in the lower byte of the data pointer register to AAH using rotate instruction. 8

Group C

9. Choose the correct answer for the following: 10 x 2
   (i) Which one of the following is true with respect to EEPROM?
      (a) Contents can be erased bytewise only.
(b) Contents of full memory can be erased together.
(c) Contents can be erased using ultraviolet rays.
(d) Contents cannot be erased.

(ii) What will be the contents of register AL after the following has been executed:

```
MOV BL, 8C
MOVAL, 7E
ADD AL, BL
```
(a) 0A and carry flag is set.
(b) 0A and carry flag is reset.
(c) 6A and carry flag is set.
(d) 6A and carry flag is reset.

(iii) In the instruction FADD, F stands for

(a) Far
(b) Floppy
(c) Floating
(d) File

(iv) LOCK prefix is used most often

(a) during normal execution.
(b) during DMA accesses.
(c) during interrupt servicing.
(d) during memory accesses.

(v) Direction flag is used with

(a) string instructions.
(b) stack instructions.
(c) arithmetic instructions.
(d) branch instructions.

(vi) Ready pin of a microprocessor is used to

(a) indicate that the microprocessor is ready to receive inputs.
(b) indicate that the microprocessor is ready to receive outputs.
(c) introduce wait states AC23 microprocessor based system design 3.
(d) provide direct memory access.

(vii) What are level triggering interrupts?

(a) INTR and TRAP
(b) RST 6.5 and RST 5.5
(c) RST 7.5 and RST 6.5
(d) None of the three above.

(viii) Which interrupt has the highest priority?

(a) INTR
(b) TRAP
(c) RST 6.5
(d) RST 7.5

(ix) The pentium microprocessor has ________ execution units.
   (a) 1
   (b) 2
   (c) 3
   (d) 4

(x) Number of times the instruction sequence, as given below, will loop before coming out of loop is

MOV AL, 00h
A1 : INC AL
JNZ A1
   (a) 00
   (b) 01
   (c) 255
   (d) 256
W’15 : 6 AN : CP 425/EL 415/425/435/
EC 405 (1460)

MICROPROCESSORS AND
MICROCONTROLLERS

Time : Three hours

Maximum Marks : 100

Answer five questions, taking any two from Group A,
any two from Group B and all from Group C.

All parts of a question (a, b, etc.) should be
answered at one place.

Answer should be brief and to-the-point and be supple-
mented with neat sketches. Unnecessary long answer may
result in loss of marks.

Any missing or wrong data may be assumed suitably
giving proper justification.

Figures on the right-hand side margin indicate full marks.

Group A

1. (a) Draw the block diagram of 8085 microprocessor
giving functions of timing and control unit.

   8

(b) List the functions of following pins of 8085:

   ALE, AD₈ – AD₁, RD, WR, READY, IO/M

   6

(c) Explain the function of SP. Why is it a 16-bit
register?

   6

2. (a) Explain following instructions and list their addressing modes:

   4 × 2

   LDA 2000H  MOV r1, r2  MVIA, 25H ADDB
(b) What do you mean by the addressing modes? List different addressing modes of 8085 with suitable examples.

(c) Write an assembly language program to add two 8-bit numbers stored in the memory locations 2501 and 2502, assuming the sum is 16-bit with suitable flow-chart. Store the result in memory location 2503 and 2504.

3. (a) What is the max addressing capacity of 8086. Compare the microprocessor 8085 with 8086.

(b) Discuss the register organization of 8086.

(c) Differentiate between static RAM and dynamic RAM.

4. (a) How to determine the control word of 8255? Write the control word for the following port setting in mode 0:

- Port A – input, Port B – output, Port C_u – input,
- Port C_l – output

(b) Draw a circuit diagram to generate the firing pulse of a thyristor using microprocessor.

(c) Write a program to generate delay using a register pair. Explain with the flow-chart.

Group B

5. (a) Differentiate between microprocessors and microcontrollers.

(b) List the following for microcontroller 8051:

(i) Size of PSW and SP

(ii) Size of internal RAM

(iii) Internal ROM

(iv) Number of Register Banks and their addresses

(c) Draw the internal architecture of microcontroller 8051 and explain the function of PC and DPTR.

6. (a) What do you mean by addressing modes? List and explain different addressing modes of 8051 with at least one example.

(b) Explain external addressing with the help of schematic diagram using instruction MOVX and MOVC.

(c) List different general purpose registers of microcontroller 8051 and explain their functions. Compare them with general purpose registers of microprocessor 8085.

7. (a) Write programs to accomplish the desired task listed below:

(i) Place the number 8Ah in the internal RAM location 30 h and 32 h.

(ii) Copy the data at internal RAM location 70 h to R0 and R3.

(b) Show the result of operations of following instructions on the respective registers and flag stating both binary and corresponding hex values:

MOV A, #0A5 h
RRA
RRA
RRA
RRA
SWAPA
CLR C
RRC A

(c) What is TCON? Write codes to copy a given byte in TCON to register R2:

(i) Use R1 as pointer to R2, and

(ii) Using PUSH command

8. (a) Write a program to add given unsigned numbers stored in internal RAM locations 21 h, 22 h and 23 h and store the result in RAM locations 30 h and 31 h.

(b) Write a program to store a given number in internal RAM location 3 Bh and increment it until the number equals 20 h.

(c) Explain the jump instruction ranges with the help of a schematic diagram.

Group C

9. Choose the correct answer for the following: 10 x 2

(i) The instruction XCHG exchanges the contents of register pair ______ with the content of ______ register pair.

(a) PC and HL
(b) BC and DE
(c) DE and HL
(d) BC and HL

(ii) In a microprocessor, the address of the next instruction to be executed is stored in

(a) stack pointer.
(b) program counter.
(c) address latch.
(d) HL pair.

(iii) The 8085 assembly language instruction that stores the contents of H and L registers into the memory location 2050H and 2051H, respectively is

(a) SPHL 2050H
(b) SPHL 2051H
(c) STAX 2050H
(d) SHLD 2050H

(iv) Consider the following 8085 assembly program:

MV1 B, 98H
MOV A, B
MOV C, A
MV1 D, 47H
OUT PORT 1
HLT

The output at PORT 1 is

(a) 98
(b) 47
(c) 00
(d) None of the three above.
(v) The number of hardware interrupt (which require an external signal to interrupt) present in an 8085 microprocessor is

(a) 1
(b) 5
(c) 4
(d) 9

(vi) Decimal equivalent of fractional binary number 1101.1011 is

(a) 13.6075
(b) 13.6805
(c) 13.6875
(d) 13.6870

(vii) The PC and SP of the microcontroller 8051 are

(a) of 8-bit.
(b) of 16-bit.
(c) 8-bit and 16-bit, respectively.
(d) 16-bit and 8-bit, respectively.

(viii) Microcontroller 8051 access external RAM when

(a) $\overline{EA}$ pin is connected to ground.
(b) PC contains an address higher than the last address in the internal ROM.

(c) $\overline{EA}$ pin is connected to +5 V.
(d) Both (a) and (b) above.

(ix) In 8051, op codes that access external memory always use

(a) indirect addressing.
(b) direct addressing.
(c) Both indirect and direct addressing.
(d) register addressing.

(x) Status flags of 8085 and 8086 microprocessors are

(a) 4 and 8, respectively.
(b) 4 and 9, respectively.
(c) 5 and 9, respectively.
(d) 8 and 16, respectively.
S’16: 6 AN:CP425/EL415/425/435/EC405 (1460)
MICROPROCESSORS AND MICROCONTROLLERS
Time : Three hours
Maximum Marks : 100

Answer FIVE questions, taking ANY TWO from Group A, ANY TWO from Group B and ALL from Group C.

All parts of a question (a, b, etc.) should be answered at one place.

Answer should be brief and to-the-point and be supplemented with neat sketches. Unnecessary long answer may result in loss of marks.

Any missing or wrong data may be assumed suitably giving proper justification.

Figures on the right-hand side margin indicate full marks.

Group A

1. (a) Explain all the pins’ functions of 8085 microprocessor.
   10

(b) Explain, with a proper circuit diagram, how demultiplexing of AD9 – AD7 bus is done to obtain both A3 – A1 bus and D0 – D3 bus.
   10

2. Explain the following instructions and list their addressing modes : (i) LHLD 2000H, (ii) DAD H, (iii) DAA, (iv) XRAA, (v) RAR, (vi) ADC M, (vii) JPO 4000H, (viii) CNZ 6000H, (ix) PCHL and (x) RC.
   10 x 2

3. (a) Write an assembly language program for finding the minimum byte of a string of bytes stored in consecu-

   ( Turn Over )
8. (a) Discuss the internal architecture of 8086 microprocessor. Also, discuss the pin out diagram of 8086 microprocessor. 5 + 5
(b) How does 8086 microprocessor work in ‘minimum mode’ operation? Explain with a neat circuit diagram. 5
(c) Write a 8086 microprocessor-based assembly language program for commutative addition of 08 word data stored in memory locations consecutively. 5

Group C

9. Choose the correct answer for the following: 10 × 2

(i) SHLD 2000H instruction of 8085 microprocessor stores data in 2000H memory locations.
(a) Yes  (b) No  (c) Not applicable

(ii) XCHG instruction of 8085 microprocessor exchanges byte data of BC and DE register pairs.
(a) Yes  (b) No  (c) Not applicable

(iii) Consider the following 8085 assembly language program:

```
MVI C, 08H
MVI B, A6H
MVI D, 00H
XRAA
```

```
LOOP: MOV A, B
RAI
MOV B, A
MOV A, D
RAR
MOV D, A
DCR C
JNZ LOOP
RST 1
```

8. (a) Discuss the internal architecture of 8086 microprocessor. Also, discuss the pin out diagram of 8086 microprocessor. 5 + 5
(b) How does 8086 microprocessor work in ‘minimum mode’ operation? Explain with a neat circuit diagram. 5
(c) Write a 8086 microprocessor-based assembly language program for commutative addition of 08 word data stored in memory locations consecutively. 5

Group C

9. Choose the correct answer for the following: 10 × 2

(i) SHLD 2000H instruction of 8085 microprocessor stores data in 2000H memory locations.
(a) Yes  (b) No  (c) Not applicable

(ii) XCHG instruction of 8085 microprocessor exchanges byte data of BC and DE register pairs.
(a) Yes  (b) No  (c) Not applicable

(iii) Consider the following 8085 assembly language program:

```
MVI C, 08H
MVI B, A6H
MVI D, 00H
XRAA
```

```
LOOP: MOV A, B
RAI
MOV B, A
MOV A, D
RAR
MOV D, A
DCR C
JNZ LOOP
RST 1
```

8. (a) Discuss the internal architecture of 8086 microprocessor. Also, discuss the pin out diagram of 8086 microprocessor. 5 + 5
(b) How does 8086 microprocessor work in ‘minimum mode’ operation? Explain with a neat circuit diagram. 5
(c) Write a 8086 microprocessor-based assembly language program for commutative addition of 08 word data stored in memory locations consecutively. 5

Group C

9. Choose the correct answer for the following: 10 × 2

(i) SHLD 2000H instruction of 8085 microprocessor stores data in 2000H memory locations.
(a) Yes  (b) No  (c) Not applicable

(ii) XCHG instruction of 8085 microprocessor exchanges byte data of BC and DE register pairs.
(a) Yes  (b) No  (c) Not applicable

(iii) Consider the following 8085 assembly language program:

```
MVI C, 08H
MVI B, A6H
MVI D, 00H
XRAA
```

```
LOOP: MOV A, B
RAI
MOV B, A
MOV A, D
RAR
MOV D, A
DCR C
JNZ LOOP
RST 1
```
The result in the D register is

(a) 6A  (b) 56  (c) 65  (d) 46

(iv) RST 5.5 hardware interrupt of 8085 microprocessor is edge and level triggered.
(a) Yes  (b) No  (c) Not applicable

(v) Which peripheral device supplies the ISR address for the INTR interrupt of 8085 microprocessor?
(a) 8257  (b) 8259  (c) 8255  (d) 8253

(vi) Microcontroller 8051 access external RAM when

(a) \( \overline{E_A} \) pin is connected to +5 V.
(b) \( 
\overline{E_A} \) pin is connected to ground.
(c) \( E_A \) pin is connected to +5 V.

(vii) In 8051, op codes that access external memory always use

(a) direct addressing.
(b) register addressing.
(c) indirect addressing.

(viii) Which SFR of 8051 microcontroller is programmed for the change of register bank?

(a) PC  (b) PSW  (c) A  (d) B  (e) R \( \phi \)

(x) Which port(s) of 8051 microcontroller does require pull up registers for port operation?

(a) P\( \phi \)  (b) P1  (c) P2  (d) P3

Decimal equivalent of fractional Hex number D.B is

(a) 13.6805
(b) 13.6875
(c) 13.6870

Continued
W'16 : 6 AN : CP 425/EL 415/425/435/EC 405 (1460)

MICROPROCESSOR AND MICROCONTROLLERS

Time : Three hours

Maximum Marks : 100

Answer FIVE questions, taking ANY TWO from Group A, ANY TWO from Group B and ALL from Group C.

All parts of a question ( a, b, etc. ) should be answered at one place.

Answer should be brief and to-the-point and be supplemented with neat sketches. Unnecessary long answer may result in loss of marks.

Any missing or wrong data may be assumed suitably giving proper justification.

Figures on the right-hand side margin indicate full marks.

Group A

1. (a) What are the different registers of 8085 microprocessor ? Discuss their function.  

(b) List six different groups to classify pins of microprocessor 8085. Identify the group and list the functions of following signals of 8085 :

IO/M, INTR, SID, ALE  

(c) List and explain the functions of different status flags of Intel 8085. Show the status of different status flags for ADD operation on numbers CBH and E9H.  

(Turn Over)
2. (a) Explain following instructions and list their addressing modes:
   
   LHLD 2000H          XCHG
   CMP M                JMP 2500H

   (b) The instruction code 4 FH is stored in the memory location 2005H. Illustrate the data flow and list the sequence of events when the instruction code is fetched by the MPU.

   (c) What is Subroutines? Explain in brief. If a subroutine is called what will be the effect on the content of SP and PC. Which will be the last mandatory instruction in subroutines?

3. (a) What is stack? What is the function of stack pointer? Explain stack operation using PUSH and POP instruction.

   (b) Write an assembly language program to add two 16-bit numbers, assuming the sum is 16-bit or more with the help of suitable flow chart. Use memory locations 2501 onwards to store the data and results.

   (c) What is the max addressing capacity of 8086. Compare microprocessor 8085 with 8086.

4. (a) How to determine the control word of 8255. Write the control word for the following port setting in mode 0:

   Port A - input, Port B - output, Port C0 - input, Port C1 - output

   (b) List different maskable and non-maskable interrupts of 8085. Write a program to enable RST 6.5 and disable RST 5.5 and 7.5.

5. (a) Discuss the register organisation of microprocessor 8086.

   Group B

   5. (a) Draw the block diagram of a microcontroller and compare it with microprocessors.

   (b) Draw the organization of internal RAM of microcontroller 8051 showing three distinct areas. Mark their respective addresses.

   (c) Discuss the register organisation of microcontroller 8051:

   (i) Word size and size of SP

   (ii) Size of internal RAM and ROM

   (iii) Number of Register Banks and their addresses.

6. (a) What do you mean by addressing modes? List and explain different addressing modes of 8051 with at least one example.

   (b) What is stack and stack pointer? Discuss their functions with schematic diagram for microcontroller 8051.

   (c) Write a note on the 8051 oscillator and clock circuit with suitable diagram. What is the min and max clock frequency?

7. (a) What is TCON? Write codes to copy a given byte in TCON to register R2:

   (i) Use R1 as pointer to R2

   (ii) Using PUSH command
What are the four distinct physical parts of memory?

List and briefly explain different opcodes used to move data.

Explain with the help of schematic diagram use of instructions MOVX and MOVC.

Write a program to add the unsigned numbers placed in internal RAM locations 25h, 26h and 27h. Place the result in RAM locations 30h and 31h.

What is the difference between a long jump (LIJP), short jump (SJMP) and absolute jump (AJMP)?

How 8-bit multiplication and divisions are performed in microcontroller 8051? What are the registers used?

Group C

Choose the correct answer from the multiple options: 10 × 2

(i) Given \((125)_m = (203)_5\). The value of radix \(R\) will be:

(a) 8  (b) 16  (c) 10  (d) 6

(ii) The equivalent decimal of fractional binary number 11101.011 is:

(a) 29.375
(b) 29.257
(c) 29.175
(d) 29.325

(iii) The 8085 assembly language instruction that stores the contents of H and L registers into the memory location 2000H and 2001H, respectively, is:

(a) SPHL 2000H
(b) SHLD 2000H
(c) SPHL 2001H
(d) STAX 2000H

(iv) Which one of the following is a non-maskable interrupt?

(a) TRAP
(b) RST 7.5
(c) RST 6.5
(d) RST 5.5

(v) In a microprocessor the register which holds the address of the next instruction to be fetched is:

(a) Accumulator
(b) Program Counter
(c) Stack Pointer
(d) Instruction Register

(vi) The size of stack pointer in microprocessor 8085 and microcontroller 8051 is ——— and ——— bit respectively.

(a) 8 and 8
(b) 8 and 16
(c) 16 and 8
(d) 16 and 16

(vii) The instruction that does not clear the accumulator of 8085, is:
(a) XRA, A
(b) ANI 00H
(c) MVIA, 00H
(d) None of these.

(viii) Microcontroller 8051 access external RAM when:
(a) EA pin is connected to ground
(b) PC contains an address higher than the last address in the internal ROM
(c) EA pin is connected to +5V
(d) Both (a) and (b).

(ix) In microcontroller 8051, the SP is of ______ wide register, and it may be defined anywhere in the ______.
(a) 8 byte, on-chip 128 byte RAM
(b) 8 bit, on chip 256 byte RAM
(c) 16 bit, on-chip 128 byte ROM
(d) 8 bit, on chip 128 byte RAM

(x) After reset, SP register is initialized to address ______.
(a) 08H  (b) 09H  (c) 07H  (d) 06H
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