NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY ENGINEERING

DEPARTMENT OF ELECTRONIC ENGINEERING

TEE2112/EEE2112 MICROPROCESSORS

Examination Paper

December 2024

This paper consists of **SIX (6)** pages

Time Allowed: **3 hours**

Total Marks: **100**

Examiner's Name: Mr B Sadock

INSTRUCTIONS

1. **ALL** questions
2. Section A carries **30 Marks**, Section B carries **40 Marks** and Section C carries **30 Marks**
3. If any doubt exists as to the interpretation of any question, the candidate is urged to submit, within their answer, a clear statement of any assumptions made.
4. Draw neat graphs and sketches where necessary.
5. Tie or staple each additional answer script in the upper left-hand corner.

Requirements

1. Non-Programmable Calculator

SECTION A (30 marks)

Multiple Choice Questions

Choose the appropriate answer for the following questions from the given options and write down the letter that corresponds to it. [30]

1. The program counter in a microprocessor
   (a) keeps the address of the next instruction to be fetched
   (b) counts the number of instructions being executed on the microprocessor
   (c) counts the number of programs being executed on the microprocessor
   (d) counts the number of interrupts handled by the microprocessor

2. If a microprocessor is capable of addressing 64K bytes of memory, its address bus width is
   (a) 16 bits (b) 20 bits (c) 8 bits (d) none of these

3. Opcode is
   (a) the part of the construction which tells the computer what operation to perform
   (b) an auxiliary register that stores the data to be added or subtracted from the accumulator
   (c) the register that receives the constructions from memory
   (d) the data which will be used in data manipulation of instruction

4. Three-byte instructions should have
   (a) opcode and an operand (b) opcode only
   (c) opcode and two operand (d) operand only

5. The number of flags of the 8086 microprocessor is
   (a) 7 (b) 8 (c) 9 (d) 10

6. When a CALL instruction is executed, the stack pointer register is
   (a) decremented by two (b) incremented by two
   (c) decremented by one (d) incremented by one

7. MOV A, C is executed by
   (a) 1 machine cycle (b) 2 machine cycle
   (c) 3 machine cycle (d) 4 machine cycle

8. The PC contains 8452H and SP contains 88D6H. What will be the content of PC and SP following a CALL to subroutine at the location 82AFH?
   (a) 82AF, 88D4 (b) 82AF, 8450 (c) 8450, 88D4 (d) 82AF, 8452

9. The data bus of a microprocessor is
   (a) unidirectional (b) bi-directional
   (c) unidirectional as well as bi-directional (d) none of these

10. A microprocessor performs as

(a) CPU of a computer
(b) memory of a computer
(c) output device of a computer
(d) input device of a computer

11. Which is the highest priority interrupt in the 8085 microprocessor?

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

12. OUT 02H is executed by

(a) one machine cycle
(b) two machine cycles
(c) three machine cycles
(d) Four machine cycles

13. The word size of the 8085 microprocessor is

(a) 8-bits (b) 16-bits (c) 20-bits (d) 4-bits

14. For using a microprocessor-based system,

(a) a program is required
(b) the program must be stored in memory before the system can be used
(c) the program need to be stored in memory
(d) the program is stored in the internal resistors of the microprocessor.

15. READY is used for

(a) input (b) output (c) both (a) and (b) (d) none of these

16. Which of the following microprocessors has a 16-bit address bus?

(a) 4004 (b) 8080 (c) 8085 (d) 8086

17. A microprocessor is an

(a) SSI device (b) MSI device (c) LSI device (d) VLSI device

18. The 8085 microprocessor is a

(a) 40 pin IC (b) 32 pin IC (c) 28 pin IC (d) 24 pin IC

19. An 8-bit microprocessor has an

(a) 8-bit data bus (b) 8-bit address bus (c) 8-bit control bus (d) 8 interrupt lines

20. Flip-flops are used in a microprocessor to indicate.

(a) Shift register (b) latches (c) country (d) flags

21. CALL 8000H is an instruction of

(a) direct addressing mode
(b) indirect addressing mode
(c) register addressing mode
(d) immediate addressing mode

22. When the RET instruction is executed at the end of a subroutine,
    (a) the memory address of the RET instruction is transferred to the program counter
    (b) two data bytes stored in the top locations of the stack are transferred to the stack pointer
    (c) the data where the stack is initialized is transferred to the stack pointer
    (d) two data bytes stored in the top two locations of the stack are transferred to the program counter

23. The number of address lines required to access 2 Mbytes of data from the microprocessor
    (a) 16-bit address lines (b) 8-bit address lines
    (c) 20-bit address lines (d) 21-bit address lines

24. Which of the following is a type of microprocessor?
    a) CISC
    b) RISC
    c) EPIC
    d) All of the mentioned

25. The RIM instruction is used to
    (a) enable RST 7.5, 6.5 and 5.5 (b) disable RST 7.5, 6.5 and 5.5
    (c) enable or disable RST 7.5, 6.5 and 5.5 (d) none of these

26. What are the control signals of the 8085 microprocessor used to interface I/O devices?
    (a) $IO\ /\ \overline{M}, \overline{RD}, \overline{WR}$ (b) $IO\ /\ \overline{M}$ (c) $\overline{RD}$ (d) $\overline{WR}$

27. To design a 4 KB RAM with 1024-byte RAM ICs, how many ICs are required?
    (a) 4 (b) 8 (c)2 (d) none of these

28. 2's complement instruction is
    (a) NEG (b) NOT (c) CMP (d) CMC

29. The SUB A instruction in 8085 microprocessor
    (a) resets the carry and sign flag (b) sets the zero and parity flag
    (c) sets the zero and carry flag (d) resets the zero and sign flag

30. Address bus of a microprocessor is
    (a) unidirectional (b) bi-directional
    (c) unidirectional as well as bi-directional (d) none-of these

SECTION B (30 marks)

Short Answer Questions

1. Describe the function of a clock in a microprocessor system. Why is it essential? [5]
2. What is the difference between a microprocessor and a microcontroller? [4]
3. What are three characteristics that can be used to calssify microprocessors. [6]
4. Define stack. Explain function of PUSH and POP instructions. [5]
5. Explain the concept of tristate logic and its importance in microprocessor-based systems. [5]
6. What is the purpose of a microprocessor in a computer system? Explain its basic functions. [5]

SECTION C (40 marks)

Programming Questions

1. a) Write an assembly language program of 8085 to find 1's complement of the data stored in memory location 2500 H and the result is to be stored in memory location 2501 H. [5]

   b) Write an assembly language program of 8085 to combine two hex nibbles stored in 2500 H and 2501 H memory locations, to form a byte. The least significant nibble is stored in 2500 H and most significant nibble is stored in 2501 H. The byte thus combined should be stored in 2502 H. (Let 08 H is stored in 2500 H and 09 H is stored in 2501 H, after the program is executed 2502 H should be loaded with the combined byte 89 H). [9]

   c) Draw the timing diagram of MVI B 00H. [6]

2. a) N (decimal number) data bytes are stored in the memory locations starting at 2501 H. Write an assembly language program of 8085 to check if 12 H is stored in any of the given locations. If any of the locations has 12 H then store 12 H in that location else load 00 H in that memory location. [10]

   b. Write an assembly language program of 8085 to separate a hexadecimal number into two nibbles. The hexadecimal number is stored in 2501 H memory location. The least significant nibble of the byte is to be stored in 2502 memory location and the most significant nibble is to be stored in 2503 H memory location. (Suppose 3A H is a byte stored in memory location 2501 H and the lower nibble 0A should be stored in 2502 H and 03 should be stored in 2503 H). [10]