

MCA (Revised) / BCA (Revised)**Term-End Examination****June, 2022****MCS-012 : COMPUTER ORGANISATION AND
ASSEMBLY LANGUAGE PROGRAMMING***Time : 3 hours**Maximum Marks : 100**(Weightage : 75%)*

Note : Question number 1 is **compulsory** and carries 40 marks. Attempt any **three** questions from the rest.

1. (a) Simplify the following Boolean function in SOP form by using K-map. Also draw the logic diagram of the simplified function using AND-OR-NOT gates : 5

$$F(A, B, C, D) = \Sigma (0, 2, 4, 6, 9, 11, 14)$$

- (b) Draw the logic diagram of D flip-flop. Explain its working. Make the characteristics table and excitation table for D flip-flop. 5
- (c) Why is DMA needed? What are the different functions that a DMA interface should perform? 3

- (d) A disk rotates at a speed of 6000 rpm (revolutions per minute). It has a seek time of 10 milliseconds. The disk has 100 tracks with each track having 200 sectors. Find the average access time of this disk. 3
- (e) A RAM chip has a capacity of $16\text{ K} \times 4$ bits. Answer the following questions for this RAM : $1+1+2=4$
- (i) How many numbers of input and output lines does this memory have ?
- (ii) How many address lines does it have ?
- (iii) How many such chips will be needed to construct a RAM of size 64 K Byte ?
- (f) Perform the following micro-operations in a sequence to registers R1 and R2. The initial value of R1 is 00111111 and R2 is 11000001. 5
- (i) $R \leftarrow R1 + R2 + 1$ (Add with carry)
- (ii) $R1 \leftarrow R2 + (\text{All } 1\text{s})$
in a Register (Decrement)
- (iii) $R2 \leftarrow R1$ (Transfer R1)
- (iv) $R \leftarrow R1 \wedge R2$ (AND)
- (v) $R \leftarrow \overline{R1}$ (Complement R1)
- (g) Explain the concept of Micro-program Control Unit. What is the need of control memory ? How is control memory organised ? Explain with the help of a diagram. 5

- (h) Consider the following pair of registers or offsets of size 16 bits of 8086 microprocessor. Explain how these registers or offset pairs are used to compute physical memory address of 20 bits. Show actual address computation : 4
- (i) DS has $(25CD)_h$ and offset $(004A)_h$
- (ii) SS has $(2F1A)_h$ and SP has $(1124)_h$
- (i) Write a program using 8086 assembly language that finds the smallest of three byte values stored in the memory. 6
2. (a) What is a multiplexer ? Draw the truth table and logic diagram of 2×1 multiplexer and explain its working. 4
- (b) What is half adder ? Draw the truth table for a half adder and construct the logic diagram of a half adder using AND, OR and NOT gates only. 4
- (c) Explain how an even parity bit can identify error using an example of 4 bit data. Can it identify the bit which is in error ? Give reason in support of your answer. 4
- (d) Perform the following operations using signed 2's complement notation of 8 bits. Also indicate overflow, if any. 4
- (i) $+ 59 + 83$
- (ii) $+ 59 - 83$
- (iii) $- 59 + 69$
- (iv) $- 59 - 69$
- (e) Explain the concept of Von Neumann machine, with the help of a diagram. 4

3. (a) Draw the logic diagram of a RAM cell using a J-K flip-flop. Explain various input and selection lines for this cell. Explain how reading or writing can be performed on this cell. 7
- (b) Explain the direct cache mapping scheme for a memory of size 4 K Byte and cache of size 128 byte. The main memory is byte addressible and size of one slot/line of cache is also 1 byte. 5
- (c) Explain the characteristics of the following I/O devices/interfaces : 6
- (i) DVD-ROM
- (ii) LCD monitors
- (iii) Scanner
- (d) Define the term “Interrupt” in the context of a computer, with the help of an example. 2
4. (a) Assuming that a machine has instructions of size 16 bits only. How many bits of this instruction will be required for the following ? $1+1+2=4$
- (i) Length of operation code (op-code) if the machine has 50 instructions.
- (ii) Length of addressing mode bits if machine has four different addressing modes.
- (iii) If one of the four addressing modes is direct addressing, then what would be the size of main memory address that can be supported by this machine ?

- (b) What is the role of memory stack for implementation of subroutine call and return instructions ? Explain with the help of suitable diagrams. 6
- (c) Explain the functioning of Wilkes control unit, with the help of a diagram. 5
- (d) How is a large register file used in RISC machine ? Explain with the help of a diagram. 5
- 5.** (a) Explain the following instructions of 8086 microprocessor, with the help of an example each : 8
- (i) XCHG
- (ii) LEA
- (iii) ADC
- (iv) XOR
- (b) Explain the differences between ROL and RCL instructions of 8086 microprocessor, with the help of an example each. 4
- (c) Explain the role of Interrupt Vector Table (IVT), for processing of an Interrupt in 8086 microprocessor, with the help of a diagram. 5
- (d) What is an Assembler ? Explain its purpose. 3
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