

Time: 3 Hours

Max. Marks: 80

Instructions:

- 1) **Question Number 1 is compulsory.**
- 2) Solve any **three** questions out of remaining **five** questions.
- 3) Each Question carry 20 marks.
- 4) Illustrate your answers with neat sketches wherever necessary.
- 5) Figures to the right indicate full marks.
- 6) Assume suitable additional data, if necessary and clearly state it.
- 7) All sub-questions of the same question should be grouped together.

- Q.1** (a) i.) Simplify the Boolean expression: $A \text{ AND } (B \text{ OR } (C \text{ AND } D))$ using Boolean algebra rules. **03**
- ii.) Create a truth table for the following circuit: $A \text{ AND } (B \text{ OR } C)$. **02**
- (b) Convert the IEEE-754 single-precision representation **0 10000010 010111000000000000000000** to its decimal equivalent. **05**
- (c) Discuss the significance of Decoders in address decoding. Provide the truth table for a 3-to-8 Decoder. **05**
- (d) Draw and explain Microinstruction sequencing organization. **05**
- Q.2** (a) A block-set associative cache memory consists of 128 blocks divided into four block sets. The main memory consists of 16,384 blocks and each block contains 256 eight-bit words. **10**
- i.) How many bits are required for addressing the main memory?
- ii.) How many bits are needed to represent the TAG, SET and WORD fields?
- (b) What is bus arbitration? Explain any two techniques of bus arbitration? **10**
- Q.3** (a) Draw and explain the operation of a Master-Slave J-K Flip-Flop with PRESET and CLEAR. How does it differ from a regular J-K flip-flop? **10**
- (b) Explain the concept of a microprogrammed control unit and compare it with a hardwired control unit. Describe the advantages and disadvantages of using a microprogrammed control unit. **10**
- Q.4** (a) Explain how the NAND gate can be used as a universal logic gate. Provide examples of how it can be used to implement other logic gates. **10**
- (b) How Booth's multiplication algorithm can be used to multiply $(-10)_{10}$ and $(-7)_{10}$ binary numbers. Show the intermediate steps involved in the multiplication process and explain how the final result is obtained. **10**

- Q.5 (a)** Perform the following binary arithmetic operations and show the intermediate steps and the final result. **10**
- Add the following Binary Coded Decimal (BCD) numbers: $(0101) + (1001)$.
 - Subtract the following binary numbers using 2's complement representation: $(10101) - (01110)$.
 - Multiply the following binary numbers using 1's complement representation: $(1101) * (1010)$.
 - Divide the following binary numbers using 2's complement representation: $(101101) / (110)$.
 - Perform addition in hexadecimal for the numbers: $(2A) + (1B)$.
- (b)** What is Pipeline Hazard? Give the types of pipeline hazards. Write a difference between delayed branch and branch prediction. **10**
- Q.6 (a)** Draw instruction cycle state diagram with interrupt. **05**
- (b)** What is State Table Method used for design Hardwired Control unit? **05**
- (c)** Compare with suitable parameters SRAM with DRAM. **05**
- (d)** Draw the neat block diagram for Flynn's classification. **05**