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Your Roll No.....

Sr. No. of Question Paper : 6494

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Unique Paper Code : 2344000023

Name of the Paper : Computer System Architecture

Name of the Course : **GE – B.Sc. (H) Computer Science**

Semester : II

Duration : 3 Hours

Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. The paper has **two** sections **A** and **B**. **Section A** is compulsory.
3. Attempt any **four** questions from **Section B**. Each question is of **15** marks.
4. Answer all parts of a question together.

Section A

1 (a) Represent $(-22)_{10}$ in 8-bit register by the following representations: (3)

- i. Signed magnitude representation
- ii. Signed 1's complement representation
- iii. Signed 2's complement representation.

(b) List the truth table of a three-variable exclusive-OR (XOR) function: (3)

$$x = A \oplus B \oplus C$$

(c) Explain the operations of a stack? Write one of its applications in digital computer. (3)

(d) Define pipelining and give one advantage and one limitation. (3)

P.T.O.

- (e) What is Cache Memory? How is it different from auxiliary memory? (3)
- (f) Give any three differences between GPU and CPU. (3)
- (g) Convert the following decimal numbers to the bases indicated: (3)
 - i. 724 to octal
 - ii. 58 to binary
- (h) Write the characteristic tables of SR and JK flip flops. Also, draw the diagrams of both the flip flops. (3)
- (i) Write the microoperations required to perform ISZ instruction. (3)
- (j) The content of PC in the basic computer is 3AE (all numbers are in hexadecimal). The content of AC is 7EC3. The content of memory at address 3AF is 832E. The content of memory at address 32E is 09AC. The content of memory at address 8AC is 8B9F. (3)
 - i. What is the instruction (in hexadecimal) that will be fetched and executed next and identify the operation performed?
 - ii. What will be the value of PC at the end of the instruction cycle.

Section B

- 2 (a) Perform the following binary arithmetic operations using 8-bit registers, given that 2's complement representation is used for negative numbers: (5)
- i. $(+32) + (-10)$
 - ii. $(-32) - (-10)$
- (b) Explain the concept of sequential circuits. Describe the role of clock and memory elements in sequential circuit operation with a neat block diagram. (5)
- (c) List five characteristics of CISC architectures. (5)

- 3 (a) State De-Morgan's law and prove it using truth table. (5)
- (b) Describe $m \times n$ ROM with the help of a block diagram. Differentiate among PROM, EPROM, and EEPROM. (5)
- (c) What is a microprogrammed control unit? Give the format of the 14-bit control word and thus write the microoperations that will be executed when the following control words are applied: (5)
- i. 001 001 011 00101
 - ii. 101 010 101 01010

Given the binary code for ADD is 00101 and SUB is 01010 and three-bit binary code for selecting the register corresponds to the register number.

- 4 (a) A non-pipeline system takes 100 ns to process a task. The same task can be processed in a five-segment pipeline with a clock cycle of 20 ns. Determine the speed-up ratio of the pipeline for 200 tasks. What is the maximum achievable speed-up? (5)
- (b) Explain the control signals generated by the CPU to facilitate DMA transfer with the help of a suitable diagram. (5)
- (c) Draw the diagram of a 4-bit binary adder. Explain its working with the help of an example. (5)
- 5 (a) Design a 2-to-4 line decoder using NAND gates and write its truth table. (5)
- (b) Simplify the Boolean function given below and find the complement of the simplified expression and draw the logic diagram of the original function. (5)
- $$F = x'y + xy + y'z$$
- (c) Write the sequence of micro-operations performed during the fetch and decode phases of an instruction cycle in a basic computer. Draw the flowchart for the identification of the instruction type as a Memory Reference instruction, Register Reference instruction, or Input–Output instruction. (5)

- 6 (a) Simplify the following Boolean function F together with don't care conditions: (5)

$$F(A, B, C, D) = \Sigma(0, 2, 3, 4, 6, 8, 10, 12)$$

$$d(A, B, C, D) = \Sigma(1, 9, 14)$$

Draw the logic diagram of simplified function.

- (b) Consider the basic computer organization having the content of AC and E as: (5)

$$AC = 5D2A, E = 0$$

Show the contents of AC & E after the execution of:

i) CMA ii) CIR

iii) CIL iv) INC

- (c) Write a short note on Programmed I/O. (5)

- 7 (a) Draw a flowchart to depict interrupt cycle of basic computer. (5)

- (b) An instruction is stored at location 520 with its address field at location 521. The address field has the value 750. A processor register R1 contains the number 150. (5)

Evaluate the effective address if the addressing mode of the instruction is

- i. direct;
- ii. Register Indirect with R1 having address 750;
- iii. immediate;
- iv. relative;
- v. index with R1 as the index register.

- (c) Design a full adder from its truth table and draw its logic diagram. (5)