Total number of printed pages: **3** **Programme(UG)/4th Semester/UCSE401**

2023

Computer Organization and Architecture

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1. a) Show the step-by-step multiplication process using Booth's algorithm when the following numbers are multiplied. 10

   (-133) * (-29)

   b) A non-pipeline system 50ns to process a task. The same task can be processed in a 6 segment pipeline with a clock cycle of 10ns. Determine the speed of the ratio of pipeline systems for 100 tasks. What is the maximum speed up that can be achieved? 10

2. a) Using 8-bits 2's complement integer representation, perform the following computations: 10

   i) -35 + (-11)

   ii) 19 - (-4)

   b) A computer employs RAM chips of 256 x 8 and ROM chips of 512 x 8. The computer system needs 4K bytes of RAM, 4K bytes of ROM. 10

   i. How many RAM and ROM chips are needed?

   ii. How many lines of the address bus must be used to access the memory?

   iii. Specify the number of the decoders needed to construct the given

memory capacity.

3. a) A 32 bit computer has a 32 bit memory address. It has 8KB of cache memory. The computer follows four-way set associative mapping. Each line size is 16 bytes. Show the memory address format and cache memory organization. 10

b) Consider a fully associative cache with 5 cache blocks (0-4). The memory block requests are in the order- 10

3, 8, 2, 3, 9, 1, 6, 3, 8, 9, 3, 6, 2, 1, 3

What is the hit ratio for the following cache replacement algorithms-policies

i) First-In-First Out (FIFO)

ii) Least Recently Used (LRU).

4. a) How does a DMA controller transfer data on a computer? Explain with a diagram. 10

b) Convert the following quantities to IEEE single precision floating point. 10

i) -18.125

ii) 0.0625

5. a) Write a program to evaluate the following arithmetic statement 20

$$\frac{A * B + (C - D) * E - (F / G)}{H - I + J / K}$$

i) using three address instructions format.

ii) using two address instructions format.

iii) using one address instructions format.

iv) using zero address instructions format.

6. Write short notes on (any four) 20

a) Programmed I/O

b) Interrupt-driven I/O

c) Optical Disk

d) Magnetic Disk

e) Virtual Memory

f) I/O processor