

## CE1-R3: ADVANCED COMPUTER ARCHITECTURE

### NOTE:

1. Answer question 1 and any FOUR questions from 2 to 7.
2. Parts of the same question should be answered together and in the same sequence.

Time: 3 Hours

Total Marks: 100

1.

- a) What is the difference between a microprocessor and microprogram? Are all microprogrammed computers are microprocessors?
- b) Distinguish between arithmetic and logical shifts. Show that in the former case signs are preserved.
- c) DMA access is given higher priority than CPU access to memory, why?
- d) What is critical section? What are the requirements that a critical section needs to satisfy?
- e) The memory unit of a computer has 256 K words of 32 bits each. The computer has an instruction format with four fields, an opcode field, a mode to specify one of six modes, a register address field to specify one of 56 processor registers and a memory address. Specify the instruction format. How many instructions are there at most in the computer?
- f) Classify SIMD and MIMD machine in the light of sequential and parallel machine architecture.
- g) Differentiate among SCSI, PCI and USB bus systems.

(7x4)

2.

- a) Define pipelining. Show with a simple instance how CPU enhances its performance using pipelining.
- b) Prove that the time taken by 2 stage pipelined execution of an instruction is half of the corresponding sequential execution time. Explain using timing diagram.

(8+10)

3.

- a) Explain the role of the cache memory in memory hierarchy to speed up instruction execution time.
- b) Justify the need of two separate caches in CPU performance enhancement.

(9+9)

4.

- a) How do bridges used between multiprocessor clusters allow transactions initiated on a local bus to be completed on a remote bus?
- b) What do you mean by BUS hierarchies? Can a processor put data to any BUS or read data from any BUS?
- c) Why is a crossbar switch network called a single-stage, non-blocking and permutation network?

(6+6+6)

**5.**

- a) What is superscalar processing? Illustrate with the help of an example the conditions of pipeline stalling superscalar processor.
- b) Suggest how VLIW architecture can achieve superscalar performance.

**(12+6)**

**6.**

- a) What is the motivation behind introducing parallelism into computer system? Distinguish between shared-memory and distributed-memory computers.
- b) Illustrate the application of parallel processing using the problem of computing the sum of Numbers (constants). Show how you arrange the dependency problem.

**(9+9)**

**7.**

- a) Write notes on the following: -
  - i) Synchronous vs. asynchronous parallel processing.
  - ii) Horizontal and Vertical expansion.
  - iii) Network topology and reliability in a computer network.
- b) What is the difference between a direct and an indirect address instruction?

**([3x5]+3)**