(3 Hours) **[Total Marks: 80]**

NB: 1. Question No.1 Compulsory.

2. Solve any THREE from Q.2 to Q.6

3. Assume suitable data whenever necessary with justification.

Q.1 Answer **any four** questions

(a) Describe the memory hierarchy in the computer system [05]

(b) Give different instruction formats. [05]

(c) Explain principle of locality of reference in detail [05]

(d) Differentiate between Memory Mapped IO and IO Mapped IO. [05]

(e) Explain Superscalar Architecture. [05]

Q.2 (a) A program having 10 instructions (without Branch and Call instructions) is executed on non-pipeline and pipeline processors. All instructions are of same length and having 4 pipeline stages and time required to each stage is 1nsec. [10]

i. Calculate time required to execute the program on Non-pipeline and Pipeline processor.

ii. Calculate Speedup.

(b) With a neat diagram , explain branch prediction in detail. [10]

Q.3. (a) Explain page address translation with respect to virtual memory and further explain TLB in detail. [10]

(b) What is "Microprogram"? Write microprogram for following operations. [10]

i. ADD R1, M, Register R1 and Memory location M are added and result store at Register R1.

ii. MUL R1, R2 Register R1 and Register R2 are multiplied and result store at Register R1.

Q.4 (a) Explain Bus Contention and different method to resolve it. [10]

(b) Define instruction pipelining and its various hazards in detail. [10]

Q.5. (a) Explain multi core processor architecture in detail [10]

(b) Explain Booth's Multiplication algorithm and Perform $(17)_{10}$ X $(-5)_{10}$. [10]

Q.6 Write short notes on any **two** [20]

(a) Data transfer techniques

(b) Set associative cache mapping

(c) Flynn's Classification

(d) Control unit of processor
