Time: 3 hours   **Total Marks: 80**

N.B.   **1. Question No. 1 is compulsory**
         2. Attempt any three questions from remaining five questions
         3. Assume suitable data if necessary and justify the assumptions
         4. Figures to the right indicate full marks

Q1   Answer the following questions.

A   Describe the different levels of parallelism in computing with examples   05

B   Explain Amdahl's Law and its implications on parallel computing   05

C   Discuss the principles of message passing programming with emphasis on send and   05
    receive operations

D   Compare SIMD and MIMD architectures in parallel computing. Discuss their   05
    advantages and disadvantages.

Q2   A   Analyze the communication costs in parallel machines and discuss strategies to   10
         minimize these costs. Provide examples.

     B   Explain the decomposition techniques used in parallel algorithm design. Provide   10
         examples.

Q3   A   Describe the building blocks of MPI with examples of send and receive operations.   10

     B   Explain the performance measures used in high performance computing, including   10
         speedup, efficiency, and scalability.

Q4   A   Discuss the challenges and techniques for load balancing in parallel computing.   10

     B   Explain the topology and embedding in the message passing interface (MPI).   10

Q5   A   Evaluate the scalability of parallel systems using Gustavson's Law   10
     B   Describe the architecture of General Purpose Graphics Processing Unit (GPGPU)   10
         and its applications.

Q6   A   Discuss the principles and applications of OpenCL programming.   10
     B   Explain the basic communication operations in parallel computing such as broadcast   10
         and reduction.

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