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

NOTE: 1. Question No 1 is compulsory

2. Attempt any three questions from remaining.

3. Assume suitable data if necessary.

Q1 Attempt ***any four*.**

a) Mention the levels of parallelism available in parallel processing approaches. (05)

b) Differentiate between the SIMD and MIMD architecture. (05)

c) Evaluate the 4-ary hyper tree with n=16. (05)

d) Discuss the term *collective communication* in MPI. (05)

e) Explain the cache coherence problem. (05)

Q2 a) Explain the Foster's design methodology and apply the same to any one sorting algorithm. (10)

b) Explain the term Isoeffciency of Amdahl's law. (10)

Q3 a) Derive the expression for speedup and efficiency by Amdahl's law and comment on the same. (10)

b) Discuss the CUDA memory model neatly. (10)

Q4 a) Write a small program demonstrating functional and compiler directives in OpenMP Paradigm and MPI Paradigm (10)

b) Build and evaluate the $\mathbf{2^3}$ butterfly network topology. (10)

Q5 a) Explain the CPU+GPU architecture and its processing flow. (10)

b) Differentiate between the buffered blocking and non-buffered blocking message passing operation in MPI. (10)

Q6 Attempt ***any two.***

a) Discuss MapReduce in brief. (10)

b) Discuss the fork and join model used by OpenMP. (10)

c) Comment on communication and synchronization issues in parallel computing. (10)
