BE5-R3: PARALLEL COMPUTING

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 pipelined architecture? Distinguish between Parallelism and Pipelining.
b) Why is there no use in increasing the number of processors beyond a certain point in a multiprocessor system?
c) What is cache coherence issue in multiprocessor?
d) What is loop interchange? How does that help in parallel programming?
e) Explain what is a race condition in the message passing parallel programs?
f) What is the latency for wormhole routing?
g) Explain the salient features of CISC scalar processor.

(7x4)

2.
a) Explain, steady state analysis of pipeline?
b) What do you mean by optimization of memory hierarchy, explain the addressing schemes for main memory?
c) What is Flynn's classification scheme? Does Flynn's classification scheme fail for pipelined computers?

(6+6+6)

3.
a) Illustrate the routing algorithm for the 8*8 Benes network with the permutation P = [1 3 5 7 6 8 9 0 4 2 11 10]?
b) What are permutations? Explain elementary permutations used in Interconnection networks.
c) How many steps shall be required for routing a data item from one node to another in a cube connected network?

(6+6+6)

4.
a) Explain the following terms associated with message passing programming of multi computers?
    i)   Synchronous versus asynchronous message – passing schemes.
    ii) Un-coupling between sender and receiver using buffers or mailboxes.
b) Consider the following loop nest: -

        Do   I = 1, N
        S1   A(I) = B(I)
        S2   C(I) = A(I) + B(I)
        S3   E(I) = C(I +1)
              End Do

    i)   Determine the dependence relations among the three statements.
    ii) Show how to vectorize the code with Fortran 90 statements.

(9+9)

5.
a) Explain interleaved memory configuration?
b) Explain the following terms related to shared variable programming on multi processors:
    i) Multiprogramming
    ii) Multitasking
    iii) Multithreading
    iv) Program partitioning
c) Elaborate salient features of parallel language and compilers with respect to control of parallelism and data parallelism.

(4+8+6)

6.
a) State Amadahl's law. Suppose a program runs in 100 seconds on a machine with multiple operations responsible for 80% of the time. How much is it necessary to improve the speed of multiplication of the program is to be made to run 5 times faster.
b) Explain the applicability and the restrictions involved in using Amadahl's law, Gustafson's law and Sun and Ni's law to estimate the speedup performance of an n-processor system compared with that of a single processor system?

(10+8)

7.
a) What is system deadlock problem? Explain deadlock detection and recovery.
b) What is synchronized and asynchronous parallel algorithm?
c) Explain the following:
    i) Matrix multiplication
    ii) Searching algorithms

(5+5+8)