MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

I SEMESTER M.TECH. (COMPUTER SCIENCE AND ENGINEERING)

END SEMESTER EXAMINATIONS, PART- B, FEB 2022

HIGH PERFORMANCE COMPUTING SYSTEMS [CSE 5154]

REVISED CREDIT SYSTEM
Date: 14/02/2022

Time: (75 +10) minutes MAX. MARKS: 20

Instructions:

- *Answer ALL the questions*

1A. Availability of a parallel computer system is 2-D MESH SIMD. There are *N* elements in an array to be partitioned among *p* number of processers in mesh SIMD where $p < N$. After partitioning, the respective processors perform the summation of the numbers allocated to them simultaneously. Write a parallel algorithm to perform summation by the respective processors after partitioning the numbers and also obtain the final sum. Give the time complexity analysis of your algorithm. **4M**

1B. With appropriate diagram, explain Rotating daisy chain algorithm. How the algorithm will have to handle the device priority issues? **4M**

1C. Identify and write the appropriate MPI function to meet the following requirement with suitable examples:

All the processes collect data from all other processes in the same communicator, and perform an operation on the data. **2M**

2A. Define kernel for a OpenCL program. Write a kernel program to find the square of each element of an array and add the respective elements of the original array. Also write an equivalent code for multithreaded version for the same. **4M**

2B. Write a CUDA kernel to add two Matrices A and B of dimensions M X N. Kernel uses only one block and uses M number of CUDA threads in it. Also write code snippet of the main program to show how do you read these two matrices and invoking the kernel to meet the above specification? **3M**

2C. In Question 2B, use two matrices each of size 4 X 3 with appropriate sample elements in it. Explain how exactly your kernel looks at these matrices and write down the iterative steps showing how exactly it handles the matrices. **3M**