Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

I SEMESTER M.TECH (COMPUTER SCIENCE AND ENGINEERING)

MAKEUP EXAMINATIONS, DEC/JAN 2016

SUBJECT: HIGH PERFORMANCE COMPUTER SYSTEMS [CSE 507]

REVISED CREDIT SYSTEM

Date: 30-12-2015

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ANY FIVE FULL** questions.

1A. Distinguish among computer terminologies in each of the following:

a) Parallelism versus pipelining

b) Architectural classification schemes based on the multiplicity of instruction streams and data streams 4M

1B. Two functional pipelines F1 and F2 are characterized by following reservation tables:

F1

	1	2	3	4
T1	X			X
T2		X		
T3			X	

F2

	1	2	3	4
U1	X		X	
U2				X
U3		X		

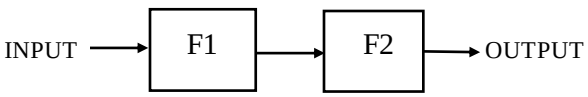

Fig.1

Determine latencies in the forbidden list F, collision vector C, state transition diagram, all simple cycles, Greedy cycles and MAL for

a) Functional pipeline F1 alone b) Functional pipeline F2 alone

c) When F1 and F2 are linearly pipelined as in Fig. 1, also find the efficiency, throughput and maximum throughput of composite functional pipeline. Given that evaluation time of composite functional pipeline is 8 clock cycles and assume τ = 20ns. 6M

2A. Implement a 3-cube network and a Omega network starting from basic principles. From this prove that n-cube network has the same topology as the repositioned Omega network with minute differences. 5M

2B. Discuss the important characteristics of Crossbar interconnection network with appropriate diagram. What is the importance of cross point in a crossbar network? 5M

3A. Give the analysis of running time calculations for a recursive function. 4M

3B. Write a parallel algorithm to sum n values in hypercube SIMD model. Given that $n = p$ where n is the number of values to be added and p is the number of processors in the model. Show such addition on 4-cube hypercube model using appropriate diagrams with suitable example. 6M

4A. Implement matrix multiplication algorithm on hypercube SIMD model and illustrate the operation of this algorithm as it multiplies a pair of 2 X 2 matrices on an 8 processor hypercube SIMD machine. 5M

4B. Draw a general bitonic sorting network using building block $\oplus$BM[k] and ΘBM[k] of input size k to sort 8 random numbers. Taking this as reference construct a bitonic sorting network using symbolic representation of increasing $\oplus$ and decreasing Θ comparators. It is expected to sort these numbers in descending order. 5M

5A. Write an MPI program to read a number N through a root process. Now see that this number communicated to rest of all the processes created. Further each process (including root process) calculate the intermediate sum up to N and then all processes send it to root to calculate the final sum and to display it by the root process. Now the root will send the final sum to all other processes using send primitive. You need to use user friendly statements where ever essential. 5M

5B. 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. 5M

6A. Write down the important steps in implementation of OpenCL with the supporting APIs. 5M

6B. Explain with appropriate diagram the overview of the CUDA device memory model. 5M