

		National Institute of Technology Meghalaya An Institute of National Importance											CURRICULUM			
		Programme		Master of Technology in VLSI and Embedded Systems						Year of Regulation			2019-2020			
Department		Electronics and Communication Engineering						Semester			II					
Course Code	Course Name	Credit Structure				Marks Distribution										
		L	T	P	C	INT	MID	END	Total							
EC 534	Parallel Computing with HPC Systems	3	0	0	3	50	50	100	200							
Course Objectives	To introduce HPC systems and its architectures	Course Outcomes	CO1	Able to distinguish the components of HPC system												
	To teach the utility of the parallel programming for complex engineering problems		CO2	Able to compare serial and parallel systems												
	To develop an ability and skill to work with GPU based parallel systems		CO3	Able to develop a parallel code and accelerate the existing algorithm HPC system.												
	To develop the parallel algorithms for real time complex engineering problems		CO4	Able to design a suitable GPU based parallel algorithm for complex system.												
No.	COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	CO1	2	2	3	1	2	0	0	0	0	0	0	0	2	2	2
2	CO2	2	2	2	1	2	0	0	0	0	0	0	0	2	2	2
3	CO3	2	2	2	1	2	0	0	0	0	0	0	0	2	3	2
4	CO4	2	2	2	1	2	0	0	0	0	0	0	0	2	3	2
SYLLABUS																
No.	Content													Hours	COs	
I	Components of an HPC system Components of a High-Performance Systems (HPC) Cluster, Properties of Login Node(s), Compute Node(s), Master Node(s), Storage Node(s), HPC Networks and so on.													4	CO1	
II	PBS - Portable Batch System Introduction to PBS, PBS basic commands, PBS `qsub`, PBS `qstat`, PBS `qdel` command, PBS `qalter`, PBS job states, PBS variables, PBS interactive jobs, PBS arrays, PBS MATLAB examples.													7	CO1	
III	SLURM -Workload Manager Introduction to Slurm, Slurm commands, A simple Slurm job, Slurm distributed MPI and GPU jobs, Slurm multi-threaded OpenMP jobs, Slurm interactive jobs, Slurm array jobs, Slurm job dependencies.													8	CO1	
	CO2															
IV	Parallel programming - OpenMP and MPI OpenMP basics, OpenMP - clauses, worksharing constructs, OpenMP- Hello World, reduction and parallel `for-loop`, section parallelization, vector addition, MPI - hello world! send/ receive and `ping-pong`													8	CO3	
V	Parallel programming - GPU and CUDA Finally, it gives you a concise beginner friendly guide to the GPUs - graphics processing units (GPU) Programming - CUDA, CUDA - hello world! and so on. Some applications of parallel programming for wireless communication systems.													10	CO3	
	CO4															
Total Hours													37			
Essential Readings																
1. Pawel Czarnul, "Parallel Programming for Modern High Performance Computing Systems", Chapman and Hall/CRC; 1 edition, 2018																
2. Quinn M. J., Parallel Programming in C with MPI and OpenMP. McGraw Hill Education; 1st edition, 2017.																
3. Sanders, Jason, and Edward Kandrot. <i>CUDA by example: an introduction to general-purpose GPU programming</i> . Addison-Wesley Professional, 1st edition, 2010.																
Supplementary Readings																
1. Hwu, Wen-Mei W. <i>GPU computing gems emerald edition</i> . Elsevier, 1st edition, 2011.																