Course code	Course title			T	P	C							
MCSE503L	Computer Architecture and Org		3	0		3							
Pre-requisite		S	Syllabus version										
				•	v. xx	.XX							
Course Objective	es												
	vide knowledge on the basics of computer		lorga	aniza	ation								
	s the foundation to study high-performance												
	ign and develop parallel programs using pa	arallel computing	plati	form	is su	ch							
_	nMP, CUDA												
	luate the performance using profiling tools	s and optimize par	rallel	cod	les								
using v	various optimization techniques												
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Course Outcome				•	11	1							
	e the developments in the evolution of com	iputer architectur	es an	d pa	ralle	1							
	programming paradigms												
_	ehend the various programming languages	and libraries for	para	nei									
computing platforms 2. Use of profiling tools to engly to the performance of applications by interpreting													
3. Use of profiling tools to analyze the performance of applications by interpreting													
•		narallel computin	o arc	hite	ctur	the given data 4. Evolute officiency trade offs among alternative parallel computing architectures							
4. Evaluate efficiency trade-offs among alternative parallel computing architectures													
for an	efficient parallel application design		C		o car	28							
	efficient parallel application design op parallel programs using OpenMP and C.	UDA and analyze											
5. Develo	op parallel programs using OpenMP and C		e peri	form	anco	2							
5. Develo	op parallel programs using OpenMP and C eters such as speed-up, and efficiency for I		e peri	form	anco	2							
5. Develo	op parallel programs using OpenMP and C eters such as speed-up, and efficiency for I		e peri	form	anco	2							
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Structure of CUDA & Execution, Methods for operations on Device Memory, Thread

Performance Evaluation, performance bottlenecks, Profiling categories; Profiling tools: Trace

6 hours

Organization, Examples

Module:6 | Performance Analyzers

analyzer and collector (ITAC), VTune Amplifier XE, Energy Efficient Performance,							
Integrated Performance Primitives (IPP)							
Mod	dule:7	Energy Efficient Arc	hitectures		5 hours		
Ove	rview o	of power issues, CMOS De	evice-level Power	dissipation	on basics, Sources of energy		
Con	Consumption, Strategies to save power or Energy, Low power designs, Power management						
	niques						
Mod	dule:8	Contemporary Issues			1 hours		
		,	Total Lecture ho	ours:	45 hours		
Tex	t Book	(s)		"			
1.	Willian	n Stallings, Computer Org	ganization and Ar	chitecture	: Designing for		
	Perfori	nance, Pearson, 2022, 11	h Edition, Pearso	n			
			d GPU Programn	ning: An I	Integrated Approach, 2022,		
	2^{nd} ed	ition, Morgan Kaufmann					
-	erence						
1.	J.L. He	ennessy and D.A. Patterson	n. Computer Arch	nitecture:	A Quantitative Approach. 5th		
Edition, 2012, Morgan Kauffmann Publishers.							
2. Shameem Akhter, Jason Roberts, Multi-core Programming: Increasing Performance							
Through Software Multi-threading, 2010, Intel Press, BPB Publications							
Mod	le of Ev	valuation: CAT / Written A	Assignment / Qui	z / FAT			
Recommended by Board of Studies 26-07-2022							
App	roved b	y Academic Council	No. xx	Date	DD-MM-YYYY		

Course code	Course title		L	T	P	C	
MCSE503P	Computer Architecture and Organization LAB		0	0	2	1	
Pre-requisite	re-requisite		Syllabus version				
		V. XX.X		X.XX			

Course Objectives

- 1. To provide knowledge on basics of computer architectures and organization that lays foundation to study high performance architectures
- 2. To design and develop parallel programs using parallel computing platforms such as OpenMP, CUDA
- 3. To evaluate the performance using profiling tools and optimize parallel codes using various optimization techniques

Course Outcome

- 1. Outline the developments in the evolution of computer architectures and parallel programming paradigms
- 2. Comprehend the various programming languages and libraries for parallel computing platforms
- 3. Use of profiling tools to analyze the performance of applications by interpreting the given data
- 4. Evaluate efficiency trade-offs among alternative parallel computing architectures for an efficient parallel Application design.
- 5. Develop parallel programs using OpenMP and CUDA and analyze performance parameters such as speed-up, efficiency for parallel programs against serial programs

Indicative Experiments

- 1. Set-up an environment for OpenMP Programming:
 Activities: create a Project using Visual Studio, Writing Sample OpenMp Program,
 Setting up properties, compile & Execute OpenMP program, OpenMP manual study,
 Creation of Login credential on Intel for Intel Parallel Studio
- 2. OpenMP program using following construct and describe scenario for the need of construct
 - Use of Parallel Construct, Determine the Number of processors in a parallel Region, Find the thread ID of each processor
- 3. Computation of Execution Time
 - Using OpenMP clock, Using windows clock
- 4. OpenMP Program using various Environment Routines to access the processor runtime information and write interesting observations by comparing various routines
- 5. OpenMP program using following Worksharing Constructs and describe scenario for the need of construct
 - loop construct, sections construct, single construct
- 6. OpenMP program using following schedule clauses and describe scenario for the need of clause
 - Static, Dynamic, Guided
- 7. Develop parallel programs for given serial programs and profile the program using Vtune Analysis tool
 - Matrix-Matrix multiplication, Matrix-Vector multiplication
- 8. Develop parallel programs for given serial programs and profile the program using Vtune Analysis tool
 Quicksort, Minimum Spanning Tree

9.	CUDA-platform setup on NVIDIA / Google Colab							
10.	Write a CUDA C/C++ program that add two array of elements and store the result in							
	third array							
11.	Write a CUDA C/C++ program that Reverses Single Block in an Array; CUDA C/C++							
12.	Write a CUDA C program for Matrix addition and Multiplication using Shared memory							
	Total Laboratory Hours 30 hours							
Tex	Text Book(s)							
	1. 0 1 1 1 1 1 1 1 1 1							
	2 nd edition, Morgan Kaufmann							
Ref	Reference Books							
1.	1. Shameem Akhter, Jason Roberts, Multi-core Programming: Increasing Performance Through Software Multi-threading, 2010, Intel Press, BPB Publications							
Mode of Evaluation: CAT / Mid-Term Lab/ FAT								
Recommended by Board of Studies 26-07-2022								
App	Approved by Academic Council No. xx Date DD-MM-YYYY							