

**Course specification**  
(4204 Very-large-scale integration)

**Faculty:** HICIT- Higher Institute for Computers & Information Technology

**Programme(s) on which the course is given:** Under graduate program in Computer Science

**Major or minor element of programme:** Elective

**Department offering the programme:** Department of Computer Science

**Department offering the course:** Department of Computer Science

**Year / Class:** 4<sup>th</sup> Year – 2<sup>nd</sup> Semester

**Date of specification approval:** 22/2/2016

**A- Basic Information**

**Title:** Very-large-scale integration

**Code:** 4204

**Weekly Hours:**

**Lecture:** 3    **Exercise:** -

**Practical:** 3

**Total:** 6

**B- Professional Information**

**1- Course Objectives:**

The goal of parallel programming course is to introduce you to the fundamentals of parallel programming and parallel algorithms .A strong grasp of the course fundamentals will enable you to quickly pick up any specific parallel programming model that you may encounter in the future, and also prepare you for studying advanced topics related to parallelism and concurrency

**2- Program ILOs Covered by Course**

<b>Program Intended Learning Outcomes</b>			
<b>Knowledge and understanding</b>	<b>Intellectual Skills</b>	<b>Professional and practical skills</b>	<b>General and Transferable skills</b>
<b>a8, a10, a19</b>	<b>b1, b2, b4, b8, b10</b>	<b>c1, c5, c6</b>	<b>d12</b>

**3 - Intended learning outcomes of course (ILOs)**

**a- Knowledge and Understanding**

- a1. Define parallel programming principles, parallelism models, communication models, and resource limitations.
- a2. Describe the fundamental steps for designing and analyzing parallel algorithms.
- a3. Identify the fundamental of writing parallel codes.
- a4. Identify the tools, practices and methodologies used in the specification, design, implementation and critical evaluation of computer software systems.

**b- Intellectual skills**

- b1. Analyze and improve the performance of parallel applications.
- b2. Analyze traditional and nontraditional problems, set goals towards solving them, and. observe results.
- b3. Compare between parallel algorithms, methods, and techniques.

### c- Professional and practical skills

- c1. Implement, debug and run simple distributed/parallel programs using Habanero Java .
- c2. Design parallel programming applications.
- c3. Evaluate systems in terms of general quality attributes and possible tradeoffs presented within the given problem.

### d- General and transferable skills

- d1. Work effectively as an individual and as a member of a team.
- d2. Write Structural Report.

## 4- Contents

Topic	Hours	Lecture	Practical
The What and Why of Parallel Programming, Task Creation and Termination (Async, Finish)	6	3	3
Computation Graphs, Ideal Parallelism	6	3	3
Abstract Performance Metrics, Multiprocessor Scheduling	6	3	3
Parallel Speedup and Amdahl's Law	6	3	3
Future Tasks, Functional Parallelism	6	3	3
Finish Accumulators	6	3	3
Data Races, Functional & Structural Determinism	6	3	3
Map Reduce	6	3	3
Memoization	6	3	3
Loop-Level Parallelism, Parallel Matrix Multiplication	6	3	3
Iteration Grouping (Chunking), Barrier Synchronization	6	3	3
Iterative Averaging Revisited	6	3	3
Course Project	6	3	3

## 5 -Teaching and learning methods

- 5.1 Lectures
- 5.2 Tutorial Exercises
- 5.3 Practical Lab
- 5.4 Discussions.

## 6- Student assessment methods

- 6.1 Midterm Exam: To assess the knowledge and understanding achieved by the student during the previous weeks.
- 6.2 Final Exam: To evaluate what the student gain at the end of the course, and to assess: the knowledge and understanding, general skills, and intellectual skills.
- 6.3 Course Project: To allow students work in team, and to evaluate knowledge, understanding, intellectual, and transferable skills.
- 6.4 Course Work & Quizzes: To keep the student always in the course, and to evaluate knowledge, understanding, intellectual, and transferable skills.

## Assessment Schedule

Assessment	Week #
Mid Term Exam	8
Final Exam	16

<b>Course Project</b>	<b>3-14</b>
<b>Course Work &amp; Quizzes</b>	<b>2-14</b>

## Assessment Weight

<b>Assessment</b>	<b>Weigh %</b>
<b>Mid Term Exam</b>	<b>5%</b>
<b>Final Exam</b>	<b>80%</b>
<b>Course Project</b>	<b>10%</b>
<b>Course Work &amp; Quizzes</b>	<b>5%</b>
<b>Total</b>	<b>100</b>

Course Work & Quizzes: (Short Exams, Assignments, Researches, Reports, Presentations, Class/Project discussion)

## 7 -List of references

### 7.1 Text Book:

**Java Concurrency in Practice** by Brian Goetz with Tim Peierls, Joshua Bloch, Joseph Bowbeer, David Holmes and Doug Lea

**Principles of Parallel Programming** by Calvin Lin and Lawrence Snyder

**The Art of Multiprocessor Programming** by Maurice Herlihy and Nir Shavit

### 7.2 Internet Location

<https://wiki.rice.edu/confluence/display/PARPROG/COMP322>

## 8- Required Facilities

### 8.1 Tools/Software

- Net Beans
- Habanero Java Library

## 9-Course Matrices

### 9.1-Course Content/ILO Matrix

<b>Course Contents</b>	<b>a1</b>	<b>a2</b>	<b>a3</b>	<b>a4</b>	<b>b1</b>	<b>b2</b>	<b>b3</b>	<b>c1</b>	<b>c2</b>	<b>c3</b>	<b>d1</b>	<b>d2</b>
The What and Why of Parallel Programming, Task Creation and Termination (Async, Finish)	√	√	√	√		√		√	√			
Computation Graphs, Ideal Parallelism	√				√	√				√		
Abstract Performance Metrics, Multiprocessor Scheduling	√	√			√	√				√		
Parallel Speedup and Amdahl's Law	√	√			√	√	√	√	√	√		
Future Tasks, Functional Parallelism	√	√	√	√		√	√	√	√			
Finish Accumulators	√	√	√	√		√	√	√	√			
Data Races, Functional & Structural Determinism	√	√	√	√		√	√	√	√			
Map Reduce	√			√		√	√	√	√			

Memorization	√			√	√	√	√	√	√				
Abstract vs. Real Performance	√	√		√	√	√	√			√			
Loop-Level Parallelism, Parallel Matrix Multiplication	√	√	√	√		√		√	√				
Iteration Grouping (Chunking), Barrier Synchronization	√	√	√	√				√	√				
Iterative Averaging Revisited	√	√	√	√				√	√				
Course Project												√	√

### 9.2-Learning Method /ILOs Matrix

Learning Methods	a1	a2	a3	a4	a5	b1	b2	b3	c1	c2	c3	d1	d2
Lectures	√	√	√	√	√	√	√	√	√	√	√		
Tutorial Exercises					√	√	√	√	√	√	√		
Practical Lab					√	√	√	√	√	√	√		
Discussions.					√	√	√	√	√	√	√	√	√

### 9.3- Assessment Methods /ILOs Matrix

Assessment Methods	a1	a2	a3	a4	a5	b1	b2	b3	c1	c2	c3	d1	d2
Mid Term Exam	√	√	√	√	√	√	√	√	√	√	√		
Final Exam	√	√	√	√	√	√	√	√	√	√	√		
Course Project	√	√	√	√	√	√	√	√	√	√	√	√	√
Course Work & Quizzes	√	√	√	√	√	√	√	√	√	√	√	√	√

**Course Coordinator:** Dr. Fahima Maghraby ( )

**Head of Department:** Dr. Farouk Shabaan ( )

**Date:** 22/2/2016