CIIC 4019 - Course Syllabus

1. General Information:

Alpha-numeric codification: CIIC 4019
Course Title: High-Performance Computing
Number of credits: 3
Contact Period: 3 hours of lecture per week

2. Course Description:

English: Study of the fundamentals concepts associate with the performance of a computing system. Discussion of techniques for the reduction of operations with the aim of minimizing the response time of a system to problems whose solution poses a high demand of computational resources. Study of parallelization, and concurrency strategies, and practical experiences with the use of systems and tools implementing them.

Spanish: Estudio de conceptos fundamentales asociados al rendimiento de un sistema de computación. Discusión de técnicas para la reducción de operaciones con el objetivo de minimizar el tiempo de respuesta de un sistema a la solución de problemas de alta demanda computacional. Estudio de estrategias de paralelización y concurrencia y experiencias prácticas en el uso de sistemas y herramientas que las implantan.

3. Pre/Co-requisites and other requirements:

Prerequisites: CIIC 4020 or ICOM 4035

4. Course Objectives:

Students will learn the algorithms and architectures used for parallel program execution, and will write parallel programs to solve scientific and engineering problems.

5. Instructional Strategies:

□conference □discussion □computation □laboratory

□seminar with formal presentation □seminar without formal presentation □workshop

□art workshop □practice □trip □thesis □special problems □tutoring

□research □other, please specify:

6. Minimum or Required Resources Available:

Students will use the Departmental computer laboratories to complete course projects.

7. Course time frame and thematic outline

Outline	**Contact Hours**
Introduction to Parallel Computers	2
Parallelism in Processors, Multi-core processors, GPUs	6
Optimizing and Parallelizing code	3
Introduction to Parallel Architectures	3
Data and Function Parallelism	4
Shared-Memory Parallel Programming	9
Message Passing Parallel Programming	9
Hybrid Parallel Programming	3
Cloud Computing	3
Exams	3
Total hours: (equivalent to contact period)	45

8. Grading System

Quantifiable (letters) Not Quantifiable

9. Evaluation Strategies

	Quantity	**Percent**
Exams	**3**	**35%**
Final Exam	**1**	**25%**
Short Quizzes		
Oral Reports		
Monographies		

☐ **Portfolio**		
☐ **Projects**	**1**	**30%**
☐**Journals**		
☐**Other, specify: Homeworks**	**2-5**	**10%**
TOTAL:		**100%**

10. Bibliography:

1. Georg Hager and Gerhard Wellein, *Introduction to High Performance Computing for Scientists and Engineers*, CRC Press, 2010. http://dx.doi.org/10.1201/EBK1439811924. [Available via CRCnetBASE, UPRM General Library Databases]
2. John Levesque and Gene Wagenbreth, *High Performance Computing: Programming and Applications*, CRC Press, 2010. http://dx.doi.org/10.1201/b10442. [Available via CRCnetBASE, UPRM General Library Databases]
3. Jeffrey S. Vetter, *Contemporary High Performance Computing: From Petascale toward Exascale,* CRC Press, 2013. [Available via CRCnetBASE, UPRM General Library Databases]
4. Shane Cook, *CUDA Programming: A Developer's Guide to Parallel Computing with GPUs*, Morgan Kaufmann, 2012.

11. Course Outcomes

Upon completion of this course the student will be able to:	Program Student Outcomes Impacted
1. describe parallel computing architectures and performance metrics	i
2. design, implement and evaluate parallel algorithms using different parallel programming models	c, j, k
3. apply modern parallel computing tools, techniques, and standards to solve high performance computing problems	b, i, l

12. According to Law 51

Students will identify themselves with the Institution and the instructor of the course for purposes of assessment (exams) accommodations. For more information please call the Student with Disabilities Office which is part of the Dean of Students office (Office #4) at (787)265-3862 or (787)832-4040 extensions 3250 or 3258.

13. Academic Integrity

-The University of Puerto Rico promotes the highest standards of academic and scientific integrity. Article 6.2 of the UPR Students General Bylaws (Board of Trustees Certification 13, 2009-2010) states that

academic dishonesty includes, but is not limited to: fraudulent actions; obtaining grades or academic degrees by false or fraudulent simulations; copying the whole or part of the academic work of another person; plagiarizing totally or partially the work of another person; copying all or part of another person answers to the questions of an oral or written exam by taking or getting someone else to take the exam on his/her behalf; as well as enabling and facilitating another person to perform the aforementioned behavior. Any of these behaviors will be subject to disciplinary action in accordance with the disciplinary procedure laid down in the UPR Students General Bylaws.–