



**University of Engineering and Technology**  
**School of Computer Science**  
**Syllabus of Course**  
**Academic Period 2018-II**

1. **Code and Name:** CS2100. Algorithms and Data Structures
2. **Credits:** 4
3. **Hours of theory and Lab:** 2 HT; 4 HL;
4. **Professor(s)**

**Lecturer**

- Luis Eduardo Talavera Rios  
– MSc in Computer Science, Pontifical Catholic University of Rio de Janeiro, Rio de Janeiro, Brasil, 2016.

Meetings after coordination with the professor

**5. Bibliography**

- [Cor+09] Thomas H. Cormen et al. *Introduction to Algorithms*. Third Edition. ISBN: 978-0-262-53305-8. MIT Press, 2009.
- [Fag+14] José Fager et al. *Estructura de datos*. First Edition. Iniciativa Latinoamericana de Libros de Texto Abiertos (LATIN), 2014.

**6. Information about the course**

- (a) **Brief description about the course** The theoretical foundation of all branches of computing rests on algorithms and data structures, this course will provide participants with an introduction to these topics, thus forming a basis that will serve for the following courses in the career.
- (b) **Prerequisites:** CS1103. Objects oriented programming II. (3<sup>rd</sup> Sem)
- (c) **Type of Course:** Mandatory
- (d) **Modality:** Face to face

**7. Specific goals of the Course**

- Make the student understand the importance of algorithms for solving problems.
- Introduce the student to the field of application of data structures.

**8. Contribution to Outcomes**

- a) An ability to apply knowledge of mathematics, science. (**Usage**)
- b) An ability to design and conduct experiments, as well as to analyze and interpret data. (**Usage**)
- c) An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. (**Usage**)
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## 9. Competences (IEEE)

- C1.** An intellectual understanding and the ability to apply mathematical foundations and computer science theory.⇒  
**Outcome a**
- C2.** Ability to have a critical and creative perspective in identifying and solving problems using computational thinking.  
⇒ **Outcome b**
- C5.** Ability to implement algorithms and data structures in software.⇒ **Outcome c**
- CS2.** Identify and analyze criteria and specifications appropriate to specific problems, and plan strategies for their solution.⇒ **Outcome b**
- C1.** An intellectual understanding and the ability to apply mathematical foundations and computer science theory.⇒  
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- C2.** Ability to have a critical and creative perspective in identifying and solving problems using computational thinking.  
⇒ **Outcome b**
- C5.** Ability to implement algorithms and data structures in software.⇒ **Outcome c**
- CS2.** Identify and analyze criteria and specifications appropriate to specific problems, and plan strategies for their solution.⇒ **Outcome b**

## 10. List of topics

1. Grafos
2. Matrices Esparzas
3. Arboles Equilibrados

## 11. Methodology and Evaluation

### Theory Sessions:

The theory sessions are held in master classes with activities including active learning and roleplay to allow students to internalize the concepts.

### Lab Sessions:

In order to verify their competences, several activities including active learning and roleplay will be developed during lab sessions.

### Oral Presentations:

Individual and team participation is encouraged to present their ideas, motivating them with additional points in the different stages of the course evaluation.

### Reading:

Throughout the course different readings are provided, which are evaluated. The average of the notes in the readings is considered as the mark of a qualified practice. The use of the UTEC Online virtual campus allows each student to access the course information, and interact outside the classroom with the teacher and with the other students.

### Evaluation System:

The final grade  $NF$  is obtained through of:

$$NF = 0.20 * EP + 0.20 * EF + 0.2 * PY_1 + 0.3 * PY_2 + 0.10 * TE$$

Where:

**PY** : Final Project (2)

**EP** : Partial Exam

**EF** : Final Exam

**TE**: Extra homework Extra

To pass the course you must obtain 11 or more in the final grade  $NF$ .

## 12. Content

<b>Unit 1: Grafos (12)</b>	
<b>Competences Expected: C1,C2,C5</b>	
<b>Learning Outcomes</b>	<b>Topics</b>
<ul style="list-style-type: none"> <li>• Acquire Dexterity to Perform Correct Implementation. [Usage]</li> <li>• Develop knowledge to decide when it is better to use one implementation technique than another. [Usage]</li> </ul>	<ul style="list-style-type: none"> <li>• Graph Concept</li> <li>• Directed Graphs and Non-directed Graphs.</li> <li>• Using Graphs.</li> <li>• Measurement of efficiency ,in time and space.</li> <li>• Adjacency matrices.</li> <li>• Tag adjacent matrices.</li> <li>• Adjacency Lists.</li> <li>• Implementation of graphs using adjacency matrices.</li> <li>• Graph Implementation using adjacency lists</li> <li>• Insertion, search and deletion of nodes and edges.</li> <li>• Graph search algorithms.</li> </ul>
<b>Readings :</b> [Cor+09], [Fag+14]	

<b>Unit 2: Matrices Esparzas (8)</b>	
<b>Competences Expected: C1,C2,C5</b>	
<b>Learning Outcomes</b>	<b>Topics</b>
<ul style="list-style-type: none"> <li>• Understand the use and implementation of scatter matrices.[Assessment]</li> </ul>	<ul style="list-style-type: none"> <li>• Initial concepts.</li> <li>• Dense Matrices</li> <li>• Measurement of Efficiency in Time and Space</li> <li>• Static scatter vs. dynamic matrix creation.</li> <li>• Insert, search, and delete methods.</li> </ul>
<b>Readings :</b> [Cor+09], [Fag+14]	

<b>Unit 3: Arboles Equilibrados (16)</b>	
<b>Competences Expected: C2,C5,C6</b>	
<b>Learning Outcomes</b>	<b>Topics</b>
<ul style="list-style-type: none"> <li>• Understand the basic functions of these complex structures in order to acquire the capacity for their implementation. [Assessment]</li> </ul>	<ul style="list-style-type: none"> <li>• AVL Trees.</li> <li>• Measurement of Efficiency.</li> <li>• Simple and Composite Rotations</li> <li>• Insertion, deletion and search.</li> <li>• Trees B , B+ B* y Patricia.</li> </ul>
<b>Readings :</b> [Cor+09], [Fag+14]	