

**Ministry of Education (MINEDU)**  
Syllabus 2021-I

**1. COURSE**

CS210. Algorithms and Data Structures (Mandatory)

**2. GENERAL INFORMATION**

<b>2.1 Credits</b>	:	4
<b>2.2 Theory Hours</b>	:	2 (Weekly)
<b>2.3 Practice Hours</b>	:	2 (Weekly)
<b>2.4 Duration of the period</b>	:	16 weeks
<b>2.5 Type of course</b>	:	Mandatory
<b>2.6 Modality</b>	:	Face to face
<b>2.7 Prerequisites</b>	:	CS113. Computer Science II. (3 <sup>rd</sup> Sem)

**3. PROFESSORS**

Meetings after coordination with the professor

**4. INTRODUCTION TO 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.

**5. GOALS**

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

**6. COMPETENCES**

- 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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- a4) (4)**
- b1) (1)**
- c1) (1)**

**7. TOPICS**

<b>Unit 1: Graphs (12)</b>	
<b>Competences Expected: a,b,c</b>	
<b>Topics</b>	<b>Learning Outcomes</b>
<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>	<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>

**Readings :** [Cor+09], [Fag+14], [Knu97], [Knu98]

<b>Unit 2: Scatter Matrices (8)</b>	
<b>Competences Expected: a,b,c</b>	
<b>Topics</b>	<b>Learning Outcomes</b>
<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>	<ul style="list-style-type: none"> <li>• Understand the use and implementation of scatter matrices.[Assessment]</li> </ul>

**Readings :** [Cor+09], [Fag+14], [Knu97], [Knu98]

<b>Unit 3: Balanced Trees (16)</b>	
<b>Competences Expected: a,b,c</b>	
<b>Topics</b>	<b>Learning Outcomes</b>
<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>	<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>

**Readings :** [Cor+09], [Fag+14], [Knu97], [Knu98]

## 8. WORKPLAN

## **8.1 Methodology**

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

## **8.2 Theory Sessions**

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

## **8.3 Practical Sessions**

The practical sessions are held in class where a series of exercises and/or practical concepts are developed through problem solving, problem solving, specific exercises and/or in application contexts.

## **9. EVALUATION SYSTEM**

\*\*\*\*\* EVALUATION MISSING \*\*\*\*\*

## **10. BASIC 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.
- [Knu97] Donald E. Knuth. *The Art of Computer Programming, Vol. 1: Fundamental Algorithms*. 3rd. Addison-Wesley Professional, 1997.
- [Knu98] Donald E. Knuth. *The art of computer programming, volume 3:Sorting and searching*. 2nd. Addison-Wesley Professional, 1998.