MINISTRY OF EDUCATION AND TRAINING
HO CHI MINH CITY OPEN UNIVERSITY

COURSE SYLLABUS

I. General information

1. Course title in Vietnamese: **CẤU TRÚC DỮ LIỆU VÀ GIẢI THUẬT**
2. Course title in English: DATA STRUCTURE AND ALGORITHMS
3. Knowledge / skill categorization:

☐General knowledge ☐ Major's *knowledge*

☒ Basic knowledge ☐Supplementary knowledge

☐ Professional knowledge ☐Graduate project / thesis

4. Number of credits

Total	Theory	Practice	Self-study
4	3	1	4(3,1,7)

5. In charge of subjects

a) Faculty: Information Technology

b) Faculty: MSc. Nguyen Chi Thanh

c) Email address: thanh.nc@ou.edu.vn

d) Office: 604

II. Course information

1. Subject Description

Data structure is one of the basic course which of computer science, equiping students with problem-solving algorithms and the complexity of algorithms.

This subject includes the following contents: special list, linked lists, binary search tree, hash table, B-tree and some popular sorting algorithms.

2. Conditional subjects

Stt	Conditional subjects	Subject code
1.	Prerequisites	Click here to enter text.
	None	
2.	Previous subject	
	Programming techniques	ITEC1504
3.	Parallel subjects	
	None	

3. Course objectives (COs)

Students who have completed their studies are capable of:

Subject objectives	Description	CSDT allocates to the subject
CO1 (Knowledge)	- Understand basic data structures such as lists (special lists, linked lists), binary search trees, hash tables, B-trees and operations on each data structure. - Understand search algorithms, sort. - Distinguish the difference between search algorithms, between sorting algorithms. - Understand how to calculate the complexity of an algorithm.	PLO3.1
CO2 (Skill)	- Ability to analyze, choose appropriate data structure, algorithms to solve problems. - Use the C++ programming language to install list data structures, search binary trees, hash tables, B-trees, and operations with each data structure. - Install algorithms to solve sorting and search problems.	PLO4.1
CO3 (Attitude)	- Have a serious and honest working spirit. - Capable of solving independent problems.	PLO13.1

4. Subject output standards (CDR)

After completing this subject, students do (achieved):

Subject objectives	Subject director	Description of the investor
CO1	CLO1.1	- Be able to estimate the complexity of algorithms.
	CLO1.2	- Analyze basic data structures such as lists (special lists, link lists), search binary trees, hash tables, B-trees and operations on each data structure.
	CLO1.3	- Distinguish the difference between search and sort algorithms.
	CLO1.4	- Apply some knowledge list (special list, linked lists), search binary tree, hash table, B-tree and cevil search algorithm, Arrange đto solve the problem.
CO2	CLO2.1	- Programming in C ++ programming language to implement list data structures, search binary trees, hash tables, B-trees and operations with each data structure
	CLO2.2	- Program technically to solve the problem of sorting and searching on the proficient graphs.
	CLO2.3	- Analyze, select appropriate data structure, algorithms to solve problems.
CO3	CLO3.1	- Improve self-study ability, self-exchange knowledge and ability to solve problems independently.

Matrix of Course Learning Outcomes (CLOs) and Program Learning Outcomes (PLOs):

Closed	PLO.3.1	PLO.4.1	PLO.13.1
CLO1.1	**4**	**4**	
CLO1.2	**4**	**4**	
CLO1.3	**4**	**4**	
CLO1.4	**4**	**4**	
CLO2.1	**4**	**4**	
CLO2.2	**4**	**4**	
CLO2.3	**4**	**4**	
CLO3.1			**4**

1: Not supported
2: Partially supported
3: Supported
4: Highly supported
5: Totally supported

5. Course materials

a) *Textbooks*

[1] Le Xuan Truong, Data Structure, Information and Communications XB House, 2018

[2] Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, Introduction to Algorithms, Third Edition, The MIT Press, 2009.

b) *References (lists up to 3 references)*

[1] Adam Drozdek, Data Structures and Algorithms in C++, Fourth Edition, CENGAGE Learning, 2013.

[2] Nguyen Duc Nghia, Data Structure and Algorithm, Bach Khoa Publishing Company, 2013.

[3] Tran Hanh Nhi, Duong Anh Duc, Hoang Kiem, Insymural Data Structure and Algorithms, University of Natural Sciences, 2003

c) *Software*

Visual Studio C++.

6. Subject Evaluation

Evaluation composition	Reviews	Subject director	Percentage %
(1)	(2)	(3)	
A1. Midterm Examination	Computer-based test	PO1.1, PO1.2, PO2.1, PO2.2	50%
	Total: 01		50%

A2. Final Examination	Paper-based final exams	PO1.2, PO1.3, PO1.4, PO2.1, PO2.2, PO2.3	0%
	Total: 01		60%
Total: 02			100%

7. Rubric mid-term review (50%)

CLO/ Qty of Question	Criteria	Good	Fair	Poor	Unsatisfactory
CLO 1.2, CLO 2.1, CLO 2.2 / 3 questions	- Analyze, apply and implement basic data structures. - Apply binary search tree, hashed table, B-Tree in storing specific data. - Distinguish between sorting algorithms, searching algorithms.	5	4	3	< 3
CLO 1.3 / 1 question	- Apply sorting algorithms, searching algorithms in specific circumstances.	2	1.5	1	< 1
CLO 1.4, CLO 2.3, CLO 2.3, CLO 3.1 / 2 questions	- Apply the basic data structures, binary search tree. - Analyze, implement the basic data structures, binary search tree reality.	3	2	1.5	< 1.5
Total		10			

8. **Teaching plans**

Teaching plans for theory (4.5 class-time unit per session)

Week/session (1)	Content (2)	Subject director (3)	Teaching and learning activities (4)	Reviews (5)	Main documents and references
1.Week 1/ Theory Session 1	Chapter 1: List 1.1 Special list. 1.1.1 Definition 1.1.2 Structure	PO1.2 PO1.4 PO2.2 PO2.3	Faculty: + Introduce detailed outlines.	A.1 A.2	[1] Chapter 1. [2] Chapter 10. [3] Chapters 3, 4.

	declaration 1.1.3 Basic operations: Add, search, delete, browse. 1.2 Single linked list. 1.2.1 Definition 1.2.2 Structure declaration 1.2.3Basic operations: Add, find, delete, browse.	PO3.1	+ Preaching + Ask questions, exercises. + Emphasize the main points. + Specify the requirements for the next lesson. Students: + Classroom learning: listening to lectures, answering questions, coring set exercises, notes. + Study at home: watch lectures, draw on the central knowledge, learn related knowledge. +On the LMS system: answer theoretical multiple choice questions, participate in discussions on the forum.		
2.Week 2/ Theory Session 2	Chapter 1: List (tt) 1.3 Circular Linked List 1.3.1 Definition 1.3.2 Structure declaration 1.3.3Basic operations: Add, find, delete, browse. 1.4 Doubly Linked List	PO1.2 PO1.4 PO2.2 PO2.3 PO3.1	Faculty: + Introduce detailed outlines. + Preaching + Ask questions, exercises. + Emphasize the main points.	A.1 A.2	[1] Chapter 1. [2] Chapter 10. [3] Chapters 3, 4.

	1.4.1 Define. 1.4.2 Structure declaration 1.4.3Basic operations: Add, find, delete, browse. 1.5 Limited list. 1.5.1 Stack. 1.5.2 Queue.		+ Specify the requirements for the next lesson. Students: + Classroom learning: listening to lectures, answering questions, coring set exercises, notes. + Study at home: watch lectures, gain key knowledge, learn related knowledge. +On the LMS system: answer theoretical multiple choice questions, participate in discussions on the forum.		
3.Week 3/ Theory Session 3	Chapter 2: Sort - Search 2.1 Sort. 2.1.1 Bubble Sort. 2.1.2 Selection Sort. 2.1.3 Insertion Sort. 2.1.4 Interchange Sort. 2.1.5 Merge Sort.	PO1. 3 PO1.4 PO2.2 PO2.3 PO3.1	Faculty: + Preaching + Ask questions, exercises. + Emphasize the main points. + Specify the requirements for the next lesson. Students: + Classroom learning: listening to lectures, answering	A.1 A.2	[1] Chapter 2. [2] Chapters 2, 3. [3] Chapter 9.

			questions, coring set exercises, notes. + Study at home: watch lectures, gain key knowledge, learn related knowledge. +On the LMS system: answer theoretical multiple choice questions, participate in discussions on the forum.		
4. Week 4/ Theory Session 4	Chapter 2: Sort - Search (tt) 2.2 Search (on the special list). 2.2.1 Sequential search 2.2.2 Binary search.	PO1. 3 PO1.4 PO2.2 PO2.3 PO3.1	Faculty: + Preaching + Ask questions, exercises. + Emphasize the main points. + Specify the requirements for the next lesson. Students: + Classroom learning: listening to lectures, answering questions, coring set exercises, notes. + Study at home: watch lectures, gain key knowledge, learn related knowledge.	A.1 A.2	[1] Chapter 2. [2] Chapters 2, 3. [3] Chapter 9.

			+On the LMS system: answer theoretical multiple choice questions, participate in discussions on the forum.		
5.Week 5/ Theory Session 5	Chapter 3: Trees 3.1 Definition 3.1.1 A number of concepts: Tree definition, node tier, tree steps, parent node, child node, path length. 3.1.2 Definition of binary trees.	PO1.2 PO1.4 PO2.1 PO2.3 PO3.1	Faculty: + Preaching + Ask questions, exercises. + Emphasize the main points. + Specify the requirements for the next lesson. Students: + Classroom learning: listening to lectures, answering questions, coring set exercises, notes. + Study at home: watch lectures, gain key knowledge, learn related knowledge. +On the LMS system: answer theoretical multiple choice questions, participate in discussions on the forum.	A.1 A.2	[1] Chapter 3. [2] Chapter 12. [3] Chapter 6.

6.Week 6/ Theory Session 6	Chapter 3: Trees (tt) 3.2 Search binary tree. 3.2.1 Definition 3.2.2 Structural declaration; Initially create an empty tree. 3.2.3 Basic operations: Add, find, delete, browse (NLR, LNR, LRN).	PO1.2 PO1.4 PO2.1 PO2.3 PO3.1	Faculty: + Preaching + Ask questions, exercises. + Emphasize the main points. + Specify the requirements for the next lesson. Students: + Classroom learning: listening to lectures, answering questions, coring set exercises, notes. + Study at home: watch lectures, gain key knowledge, learn related knowledge. +On the LMS system: answer theoretical multiple choice questions, participate in discussions on the forum.	A.1 A.2	[1] Chapter 3. [2] Chapter 12. [3] Chapter 6.
7.Week 7/ Theory Session 7	Chapter 4: Hash table 4.1 Concepts. 4.1.1 Concept 4.1.2 Hash 4.1.3 Clashes	PO1.2 PO2.1 PO3.1	Faculty: + Preaching + Ask questions, exercises. + Emphasize the main points. + Specify the	A.2	[1] Chapter 4. [2] Chapter 11. [3] Chapter 10.

			requirements for the next lesson. Students: + Classroom learning: listening to lectures, answering questions, coring set exercises, notes. + Study at home: watch lectures, gain key knowledge, learn related knowledge. +On the LMS system: answer theoretical multiple choice questions, participate in discussions on the forum.		
8.Week 8/ Theory 8	Chapter 4: Hash table (tt) 4.2 Resolving clashes. 4.2.1 Direct linking method 4.2.2 United linking methods	PO1.2 PO2.1 PO3.1	Faculty: + Preaching + Ask questions, exercises. + Emphasize the main points. + Specify the requirements for the next lesson. Students: + Classroom learning: listening to lectures, answering questions,	A.2	[1] Chapter 4. [2] Chapter 11. [3] Chapter 10.

			coring set exercises, notes. + Study at home: watch lectures, gain key knowledge, learn related knowledge. +On the LMS system: answer theoretical multiple choice questions, participate in discussions on the forum.		
9.Week 9/ Theory Session 9	Chapter 5: B-tree 5.1 B-tree overview 5.1.1 Introduction 5.1.2 Some concepts 5.2 B-tree operations 5.2.1 Create trees	PO1.2 PO1.4 PO2.1 PO2.3 PO3.1	Faculty: + Preaching + Ask questions, exercises. + Emphasize the main points. + Specify the requirements for the next lesson. Students: + Classroom learning: listening to lectures, answering questions, coring set exercises, notes. + Study at home: watch lectures, gain key knowledge, learn related knowledge. +On the	A.2	[1] Chapter 5 [2] Chapter 11. [3] Chapter 7.

			LMS system: answer theoretical multiple choice questions, participate in discussions on the forum.		
10.Week 10/ Theory 10	Chapter 5: B-tree (tt) 5.2.2Search on B-trees 5.2.3 Insert a key into the B-tree 5.2.4 Remove a key from the B-tree	PO1.2 PO1.4 PO2.1 PO2.3 PO3.1	Faculty: + Preaching + Ask questions, exercises. + Emphasize the main points. + Specify the requirements for the next lesson. Students: + Classroom learning: listening to lectures, answering questions, coring set exercises, notes. + Study at home: watch lectures, gain key knowledge, learn related knowledge. +On the LMS system: answer theoretical multiple choice questions, participate in discussions on the forum.	A.2	[1] Chapter 5 [2] Chapter 11. [3] Chapter 7.

Practical teaching plan (3.0 sessions/ session)

Week/session (1)	Content (2)	Subject director (3)	Teaching and learning activities (4)	Reviews (5)	Main documents and references
1.Week 1 / Practice Session 1	Practice Chapter 1: List	PO1.2 PO1.4 PO2.2 PO2.3 PO3.1	Faculty: + Introduce detailed outlines. + Preaching + Ask questions, exercises. + Emphasize the main points. + Specify the requirements for the next lesson. Students: + Classroom learning: listening to lectures, answering questions, coring set exercises, notes. + Study at home: watch lectures, gain key knowledge, learn related knowledge. +On the LMS system: answer theoretical multiple choice questions, participate in discussions on the forum.	A.1 A.2	[1] Chapter 1. [2] Chapter 10. [3] Chapters 3, 4.
2.Week 2 / Practice Session 2	Practice chapter 1 (tt): List	PO1.2 PO1.4 PO2.2 PO2.3 PO3.1	Faculty: + Preaching + Ask questions, exercises. + Emphasize the main points. + Specify the requirements for the next lesson.	A.1 A.2	[1] Chapter 1. [2] Chapter 10. [3] Chapters 3, 4.

			Students: + Classroom learning: listening to lectures, answering questions, coring set exercises, notes. + Study at home: watch lectures, gain key knowledge, learn related knowledge. +On the LMS system: answer theoretical multiple choice questions, participate in discussions on the forum.		
3.Week 3 / Practice Session 3	Chapter 2 Practice: Sort - Search	PO1. 3 PO1.4 PO2.2 PO2.3 PO3.1	Faculty: + Preaching + Ask questions, exercises. + Emphasize the main points. + Specify the requirements for the next lesson. Students: + Classroom learning: listening to lectures, answering questions, coring set exercises, notes. + Study at home: watch lectures, gain key knowledge, learn related knowledge. +On the LMS system: answer theoretical multiple choice questions,	A.1 A.2	[1] Chapter 2. [2] Chapters 2, 3. [3] Chapter 9.

			participate in discussions on the forum.		
4.Week 4/ Practice Session 4	Chapter Practice 2 (tt): Sort - Search	PO1. 3 PO1.4 PO2.2 PO2.3 PO3.1	Faculty: + Preaching + Ask questions, exercises. + Emphasize the main points. + Specify the requirements for the next lesson. Students: + Classroom learning: listening to lectures, answering questions, coring set exercises, notes. + Study at home: watch lectures, gain key knowledge, learn related knowledge. +On the LMS system: answer theoretical multiple choice questions, participate in discussions on the forum.	A.1 A.2	[1] Chapter 2. [2] Chapters 2, 3. [3] Chapter9.
5.Week 5/ Practice Session 5	Practice Chapter 3: Trees	PO1.2 PO1.4 PO2.1 PO2.3 PO3.1	Faculty: + Preaching + Ask questions, exercises. + Emphasize the main points. + Specify the requirements for the next lesson. Students: + Classroom learning: listening to lectures, answering	A.1 A.2	[1] Chapter 3. [2] Chapter 12. [3] Chapter 6.

			questions, coring set exercises, notes. + Study at home: watch lectures, gain key knowledge, learn related knowledge. +On the LMS system: answer theoretical multiple choice questions, participate in discussions on the forum.		
6.Week 6/ Practice Session 6	Practice chapter 3 (tt): Trees	PO1.2 PO1.4 PO2.1 PO2.3 PO3.1	Faculty: + Preaching + Ask questions, exercises. + Emphasize the main points. + Specify the requirements for the next lesson. Students: + Classroom learning: listening to lectures, answering questions, coring set exercises, notes. + Study at home: watch lectures, gain key knowledge, learn related knowledge. +On the LMS system: answer theoretical multiple choice questions, participate in discussions on the forum.	A.1 A.2	[1] Chapter 3. [2] Chapter 12. [3] Chapter 6.
7.Week 7/	Practice chapter 4:	PO1.2	Faculty:	A.2	[1] Chapter 4.

Practice Session 7	Hash table	PO2.1 PO3.1	+ Preaching + Ask questions, exercises. + Emphasize the main points. + Specify the requirements for the next lesson. Students: + Classroom learning: listening to lectures, answering questions, coring set exercises, notes. + Study at home: watch lectures, gain key knowledge, learn related knowledge. +On the LMS system: answer theoretical multiple choice questions, participate in discussions on the forum.		[2] Chapter 11. [3] Chapter 10.
8.Week 8/ Practice session 8	Practice chapter 4 (tt): Hash table	PO1.2 PO2.1 PO3.1	Faculty: + Preaching + Ask questions, exercises. + Emphasize the main points. + Specify the requirements for the next lesson. Students: + Classroom learning: listening to lectures, answering questions, coring set exercises, notes. + Study at home: watch lectures,	A.2	[1] Chapter 4. [2] Chapter 11. [3] Chapter 10.

			gain key knowledge, learn related knowledge. +On the LMS system: answer theoretical multiple choice questions, participate in discussions on the forum.		
9.Week 9/ Practice Session 9	Chapter 5 Practice: B-Trees	PO1.2 PO1.4 PO2.1 PO2.3 PO3.1	Faculty: + Preaching + Ask questions, exercises. + Emphasize the main points. + Specify the requirements for the next lesson. Students: + Classroom learning: listening to lectures, answering questions, coring set exercises, notes. + Study at home: watch lectures, gain key knowledge, learn related knowledge. +On the LMS system: answer theoretical multiple choice questions, participate in discussions on the forum.	A.2	[1] Chapter 5 [2] Chapter 11. [3] Chapter 7.
10.Week 10/ Practice Session 10	Practice chapter 5 (tt): B-Tree	PO1.2 PO1.4 PO2.1 PO2.3 PO3.1	Faculty: + Preaching + Ask questions, exercises. + Emphasize the main points.	A.2	[1] Chapter 5 [2] Chapter 11. [3] Chapter 7.

			+ Specify the requirements for the next lesson. Students: + Classroom learning: listening to lectures, answering questions, coring set exercises, notes. + Study at home: watch lectures, gain key knowledge, learn related knowledge. +On the LMS system: answer theoretical multiple choice questions, participate in discussions on the forum.		

III. Regulations of the subject

- Students who do not submit their homework and report assignments on time on the LMS, are deemed not to submit their works.

- Students who are absent more than 20% of the total practice sessions, are not allowed to take part in the mid-term exam on the computer.

DEAN OF FACULTY	**EDITOR**
(Sign and specify full name)	*(Sign and specify full name)*
Dr. Le Xuan Truong	MSc. Nguyen Chi Thanh