CENG 205 - DATA STRUCTURES AND ALGORITHMS

Course Code	Course Name	Semester	
CENG 205	Data Structures and Algorithms	Fall ☒ Spring ☐ Summer ☐	
Hours		**Credit**	**ECTS**
Theory	**Practice** / **Lab**	3	6
3	0 / 0		

Course Details	
Department	Software Engineering
Course Language	English
Course Level	Undergraduate ☒ Graduate ☐
Mode of Delivery	Face to Face ☒ Online ☐ Hybrid ☐
Course Type	Compulsory ☒ Elective ☐
Course Objectives	The primary goal of this course is to introduce students to the fundamental concepts of data structures and algorithms, with a focus on their design, analysis, and theoretical application. This course aims to: 1. Develop an understanding of the fundamental principles behind the design and analysis of basic data structures and algorithms. 2. Equip students with the skills to evaluate and choose appropriate data structures for solving specific problems. 3. Provide illustrative examples of C programming to reinforce theoretical concepts and demonstrate the practical relevance of data structures and algorithms. By the end of this course, students will gain a strong theoretical foundation in data structures and algorithms, enabling them to approach more advanced topics in software engineering.
Course Content	The course provides a comprehensive introduction to data structures and algorithms, focusing on their design, analysis, and applications. Topics include linear structures such as arrays, linked lists, stacks, and queues, as well as non-linear structures like binary trees, AVL trees, Huffman trees, and heaps. Searching methods such as linear, binary, and interpolation search, along with sorting techniques including bubble sort, insertion sort, selection sort, quicksort, mergesort, and heapsort, are covered. Advanced topics include hashing for efficient data retrieval, graph representation and traversal (DFS, BFS, Dijkstra), and minimum spanning tree algorithms (Kruskal, Prim).
Course Method/ Techniques	Lecture ☒ Question & Answer ☒ Presentation ☒ Discussion ☒
Prerequisites/ Corequisites	Prerequisite : CENG 110 - Programming and Computation II Corequisites : CENG 213 - Discrete Computing Structures
Work Placement(s)	No work placement is required for this course

Textbook/References/Materials

Textbook :

1. Thareja, Reema. *Data Structures Using C*. 2nd Edition, University of Delhi: For Women, Oxford University Press, 2014

References :

1. Lipschutz, Seymour. *Schaum's Outline of Data Structures with C*. McGraw-Hill Education, 1986.
2. Weiss, Mark Allen. *Data Structures and Algorithm Analysis in C*. 2nd Edition, Addison-Wesley, 1996.
3. King, K. N. *C Programming: A Modern Approach*. 2nd Edition, W. W. Norton & Company, 2008.
4. Kanetkar, Yashavant. *Let Us C: Authentic Guide to C Programming Language*. 19th Edition, BPB Publications, 2022.
5. Visualgo.net

Course Category

Mathematics and Basic Sciences	☐		Education	☐
Engineering	☒		Science	☐
Engineering Design	☐		Health	☐
Social Sciences	☐		Profession	☐

Weekly Schedule

No	Topics	Materials/Notes
1	Introduction to Data Structures and Algorithms	Chapter 1: Introduction to Data Structures and Algorithms
2	Time Complexity - Arrays - Structures - Linked List	Chapter 2: Algorithm Analysis (Time Complexity) Chapter 3: Arrays Chapter 5: Structures Chapter 6: Linked Lists
3	Stacks, Queues	Chapter 7: Stacks Chapter 8: Queues
4	Basic Tree Terminology - Binary Trees – Expression Trees- Traversing a Binary Tree	Chapter 9: Trees (Basic Terminology, Binary Trees, Expression Trees, Traversal)
5	Huffman’s Tree - Binary Search Trees, Threaded Binary Trees,	Chapter 9: Trees (Huffman's Tree, Binary Search Trees, Threaded Binary Trees)
6	AVL trees	Chapter 9: Trees (AVL Trees)
7	Heaps	Chapter 10: Heaps
8	Midterm Exam	
9	Searching Algorithms (Linear Search, Binary Search, Interpolation Search, Jump Search)	Chapter 11: Searching and Sorting (Linear Search, Binary Search, Interpolation Search, Jump Search)
10	Sorting Algorithms (Buble Sort, Insertion Sort, Selection Sort, Merge Sort, Quick Sort)	Chapter 11: Searching and Sorting (Bubble Sort, Insertion Sort, Selection Sort, Merge Sort, Quick Sort)
11	Hashing Algorithm	Chapter 12: Hashing

12	Graphs Terminology – Graphs Representation	Chapter 13: Graphs (Terminology, Representation)
13	Topological Sort	Chapter 13: Graphs (Topological Sort)
14	DFS, BFS and Dijkstra's algorithms	Chapter 13: Graphs (Depth-First Search, Breadth-First Search, Dijkstra's Algorithm)
15	Spanning trees-Minimum Spanning trees - Kruskal, Prim	Chapter 13: Graphs (Spanning Trees, Minimum Spanning Trees, Kruskal's and Prim's Algorithms)
16	Final Exam	

Assessment Methods and Criteria		
In-term studies	**Quantity**	**Percentage**
Attendance		
Lab		
Practice		
Fieldwork		
Course-specific internship		
Quiz/Studio/Criticize		
Homework		20%
Presentation / Seminar		
Project		
Report		
Seminar		
Midterm Exam		30%
Final Exam		50%
	Total	**100%**
Contribution of Midterm Studies to Success Grade		**50%**
Contribution of End of Semester Studies to Success Grade		**50%**
	Total	**100%**

ECTS Allocated Based on Student Workload			
Activities	**Quantity**	**Duration (Hrs)**	**Total Workload**
Course Hours	14	3	42
Lab			
Practice			
Fieldwork			
Course-specific Work Placement			
Out-of-class study time	14	3	42
Quiz/Studio/Criticize			
Homework	2	10	20
Presentation / Seminar			
Project			
Report			
Midterm Exam and Preparation for Midterm	1	20	20
Final Exam and Preparation for Final Exam	1	20	20
Total Workload			**130**
Total Workload / 25			**5,76**
ECTS Credit			**6**

Course Learning Outcomes	
No	**Outcome**
L1	Understand the fundamental concepts of data structures and algorithms, including their importance and applications.
L2	Analyze and evaluate the time and space complexity of algorithms using Big-O notation.
L3	Describe and differentiate between linear and non-linear data structures, including their operations and applications.
L4	Apply searching and sorting algorithms to solve computational problems efficiently.
L5	Understand and implement the concepts of hashing, graph representation, and traversal techniques in problem-solving.

Contribution of Course Learning Outcomes to Program Competencies/Outcomes

Contribution Level: 1: Very Slight, 2: Slight, 3: Moderate, 4: Significant, 5: Very Significant

	P1	**P2**	**P3**	**P4**	**P5**	**P6**	**P7**	**P8**	**P9**	**P10**	**P11**	**P12**	**P13**	**P14**	**P15**	**Total**
L1	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5
L2	5	5	-	5	-	-	-	-	-	-	-	-	-	-	-	15
L3	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	5
L4	-	5	-	5	-	-	-	-	-	-	-	-	-	-	-	10
L5	-	4	-	4	4	-	-	-	-	-	-	-	-	-	-	12
Total																