

UNIVERSITY OF DELHI

CNC-II/093/1(25)/2023-24/64

Dated: 30.05.2023

**NOTIFICATION**

Sub: Amendment to Ordinance V

[E.C Resolution No. 60/ (60-1-7/) dated 03.02.2023]

Following addition be made to Appendix-II-A to the Ordinance V (2-A) of the Ordinances of the University;

**Add the following:**

**Syllabi of Semester-III of the following departments under Faculty of Mathematical Sciences based on Under Graduate Curriculum Framework -2022 implemented from the Academic Year 2022-23.**

**FACULTY OF MATHEMATICAL SCIENCES**

**DEPARTMENT OF COMPUTER SCIENCE**

**BSC. (HONS.) COMPUTER SCIENCE**

**DISCIPLINE SPECIFIC CORE COURSE -7 (DSC-7) : Data Structures**

**CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE**

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
DSC07 Data Structures	4	3	0	1	Passed 12th class with Mathematics	Programming using Python/Object Oriented Programming with C++

## Learning Objectives

The course aims at developing the ability to use basic data structures like arrays, stacks, queues, lists, and trees to solve problems. C++ is chosen as the language to implement the implementation of these data structures.

## Learning outcomes

On successful completion of the course, students will be able to:

- Compare two functions for their rates of growth.
- Understand abstract specification of data-structures and their implementation.
- Compute time and space complexity of operations on a data-structure.
- Identify the appropriate data structure(s) for a given application and understand the trade-offs involved in terms of time and space complexity.
- Apply recursive techniques to solve problems.

## SYLLABUS OF DSC-7

### Unit 1 (9 hours)

**Growth of Functions, Recurrence Relations:** Functions used in analysis, asymptotic notations, asymptotic analysis, solving recurrences using recursion trees, Master Theorem.

### Unit 2 (16 hours)

**Arrays, Linked Lists, Stacks, Queues:** Arrays: array operations, applications, two-dimensional arrays, dynamic allocation of arrays; Linked Lists: singly linked lists, doubly linked lists, circularly linked lists, Stacks: stack as an ADT, implementing stacks using arrays, implementing stacks using linked lists, applications of stacks; Queues: queue as an ADT, implementing queues using arrays, implementing queues using linked lists,. Time complexity analysis.

### Unit 3 (5 hours)

**Recursion:** Recursive functions, linear recursion, binary recursion.

### Unit 4 (6 hours)

**Trees, Binary Trees:** Trees: definition and properties, tree traversal algorithms, and their time complexity analysis; binary trees: definition and properties, traversal of binary trees, and their time complexity analysis.

### Unit 5 (7 hours)

**Binary Search Trees, Balanced Search Trees:** Binary Search Trees: insert, delete, search operations, time complexity analysis of these operations; Balanced Search Trees: insert, search operations, time complexity analysis of these operations. Time complexity analysis.

### Unit 6 (2 hours)

**Binary Heap:** Binary Heaps: heaps, heap operations.

### Essential/recommended readings

1. Goodrich, M.T., Tamassia, R., & Mount, D., *Data Structures and Algorithms Analysis in C++*, 2<sup>nd</sup> edition, Wiley, 2011.
2. Cormen, T.H., Leiserson, C.E., Rivest, R. L., Stein C. *Introduction to Algorithms*, 4<sup>th</sup> edition, Prentice Hall of India, 2022.

### Additional references

1. Sahni, S. *Data Structures, Algorithms and applications in C++*, 2<sup>nd</sup> edition, Universities Press, 2011.
2. Langsam Y., Augenstein, M. J., & Tanenbaum, A. M. *Data Structures Using C and C++*, Pearson, 2009.

### Practical List (If any): (30 Hours)

#### Practical exercises such as

1. Write a program to implement singly linked list as an ADT that supports the following operations:
  - (i) Insert an element x at the beginning of the singly linked list
  - (ii) Insert an element x at  $i^{th}$  position in the singly linked list
  - (iii) Remove an element from the beginning of the singly linked list
  - (iv) Remove an element from  $i^{th}$  position in the singly link
  - (v) Search for an element x in the singly linked list and return its pointer
  - (vi) Concatenate two singly linked lists
2. Write a program to implement doubly linked list as an ADT that supports the following operations:
  - (i) Insert an element x at the beginning of the doubly linked list
  - (ii) Insert an element x at  $i^{th}$  position in the doubly linked list
  - (iii) Insert an element x at the end of the doubly linked list
  - (iv) Remove an element from the beginning of the doubly linked list
  - (v) Remove an element from  $i^{th}$  position in the doubly linked list.
  - (vi) Remove an element from the end of the doubly linked list
  - (vii) Search for an element x in the doubly linked list and return its pointer
  - (viii) Concatenate two doubly linked lists
3. Write a program to implement circular linked list as an ADT which supports the following operations:
  - (i) Insert an element x at the front of the circularly linked list
  - (ii) Insert an element x after an element y in the circularly linked list
  - (iii) Insert an element x at the back of the circularly linked list
  - (iv) Remove an element from the back of the circularly linked list
  - (v) Remove an element from the front of the circularly linked list
  - (vi) Remove the element x from the circularly linked list
  - (vii) Search for an element x in the circularly linked list and return its pointer

- (viii) Concatenate two circularly linked lists
4. Implement a stack as an ADT using Arrays.
  5. Implement a stack as an ADT using the Linked List ADT.
  6. Write a program to evaluate a prefix/postfix expression using stacks.
  7. Implement Queue as an ADT using the circular Arrays.
  8. Implement Queue as an ADT using the Circular Linked List ADT.
  9. Write a program to implement Binary Search Tree as an ADT which supports the following operations:
    - (i) Insert an element x
    - (ii) Delete an element x
    - (iii) Search for an element x in the BST and change its value to y and then place the node with value y at its appropriate position in the BST
    - (iv) Display the elements of the BST in preorder, inorder, and postorder traversal
    - (v) Display the elements of the BST in level-by-level traversal
    - (vi) Display the height of the BST
  10. Write a program to implement a balanced search tree as an ADT.

**Note:** Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.

#### DISCIPLINE SPECIFIC CORE COURSE – 8 (DSC-8): Operating Systems

#### Credit distribution, Eligibility and Prerequisites of the Course

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
<b>DSC 08 Operating Systems</b>	<b>4</b>	<b>3</b>	<b>0</b>	<b>1</b>	<b>Passed 12th class with Mathema tics</b>	Programming using Python/Object Oriented Programming with C++, Computer System Architecture