Course code	Course Name	L-T-P-Credits	Year of Introduction
CS205	Data Structures	3-1-0-4	2016

Pre-requisite: B101-05 Introduction to Computing and Problem Solving

Course Objectives

1. To impart a thorough understanding of linear data structures such as stacks, queues and their applications.
2. To impart a thorough understanding of non-linear data structures such as trees, graphs and their applications.
3. To impart familiarity with various sorting, searching and hashing techniques and their performance comparison.
4. To impart a basic understanding of memory management.

Syllabus

Introduction to various programming methodologies, terminologies and basics of algorithms analysis, Basic Abstract and Concrete Linear Data Structures, Non-linear Data Structures, Memory Management, Sorting Algorithms, Searching Algorithms, Hashing.

Expected Outcome:

Students will be able to

1. compare different programming methodologies and define asymptotic notations to analyze performance of algorithms.
2. use appropriate data structures like arrays, linked list, stacks and queues to solve real world problems efficiently.
3. represent and manipulate data using nonlinear data structures like trees and graphs to design algorithms for various applications.
4. illustrate and compare various techniques for searching and sorting.
5. appreciate different memory management techniques and their significance.
6. illustrate various hashing techniques.

Text Books:

1. Samanta D., Classic Data Structures, Prentice Hall India, 2/e, 2009.
2. Richard F. Gilberg, Behrouz A. Forouzan, Data Structures: A Pseudocode Approach with C, 2/e, Cengage Learning, 2005.

References

1. Horwitz E., S. Sahni and S. Anderson, Fundamentals of Data Structures in C, University Press (India), 2008.
2. Aho A. V., J. E. Hopcroft and J. D. Ullman, Data Structures and Algorithms, Pearson Publication,1983.
3. Tremblay J. P. and P. G. Sorenson, Introduction to Data Structures with Applications, Tata McGraw Hill, 1995.
4. Peter Brass, Advanced Data Structures, Cambridge University Press, 2008
5. Lipschuts S., Theory and Problems of Data Structures, Schaum’s Series, 1986.
6. Wirth N., Algorithms + Data Structures = Programs, Prentice Hall, 2004.
7. Hugges J. K. and J. I. Michtm, A Structured Approach to Programming, PHI, 1987.
8. Martin Barrett, Clifford Wagner, And Unix: Tools For Software Design, John Wiley, 2008 reprint.

COURSE PLAN			
Module	**Contents**	**Hours (56)**	**Sem. Exam Marks**
I	Introduction to programming methodologies – structured approach, stepwise refinement techniques, programming style, documentation – analysis of algorithms: frequency count, definition of Big O notation, asymptotic analysis of simple algorithms. Recursive and iterative algorithms.	**9**	**15%**
II	Abstract and Concrete Data Structures- Basic data structures – vectors and arrays. Applications, Linked lists:- singly linked list, doubly linked list, Circular linked list, operations on linked list, linked list with header nodes, applications of linked list: polynomials,.	**9**	**15%**
III	Applications of linked list (continued): Memory management, memory allocation and de-allocation. First-fit, best-fit and worst-fit allocation schemes Implementation of Stacks and Queues using arrays and linked list, DEQUEUE (double ended queue). Multiple Stacks and Queues, Applications.	**9**	**15%**
IV	String: - representation of strings, concatenation, substring searching and deletion. Trees: - m-ary Tree, Binary Trees – level and height of the tree, complete-binary tree representation using array, tree traversals (Recursive and non-recursive), applications. Binary search tree – creation, insertion and deletion and search operations, applications.	**10**	**15%**
V	Graphs – representation of graphs, BFS and DFS (analysis not required) applications. Sorting techniques – *Bubble sort, Selection Sort,* Insertion sort, Merge sort, Quick sort, Heaps and Heap sort. Searching algorithms (Performance comparison expected. Detailed analysis not required)	**09**	**20%**
VI	Linear and Binary search. (Performance comparison expected. Detailed analysis not required) Hash Tables – Hashing functions – Mid square, division, folding, digit analysis, collusion resolution and Overflow handling techniques.	**10**	**20%**

Question Paper Pattern:

1. There will be *five* parts in the question paper – A, B, C, D, E
2. Part A
    a. Total marks : 12
    b. *Four* questions each having *3* marks, uniformly covering module I and II; All *four* questions have to be answered.
3. Part B
    a. Total marks : 18
    b. *Three* questions each having *9* marks, uniformly covering module I and II; T*wo* questions have to be answered. Each question can have a maximum of three subparts
4. Part C
    a. Total marks : 12
    b. *Four* questions each having *3* marks, uniformly covering module III and IV; All *four* questions have to be answered.
5. Part D
    a. Total marks : 18
    b. *Three* questions each having *9* marks, uniformly covering module III and IV; T*wo* questions have to be answered. Each question can have a maximum of three subparts
6. Part E
    a. Total Marks: 40
    b. *Six* questions each carrying 10 marks, uniformly covering modules V and VI; *four* questions have to be answered.
    c. A question can have a maximum of three sub-parts.
7. There should be at least 60% analytical/numerical/design questions.