TRIBHUVAN UNIVERSITY

INSTITUTE OF SCIENCE AND TECHNOLOGY

SCHOOL OF MATHEMATICAL SCIENCES

Bachelor in Mathematical Sciences (B.Math.Sc.)

Course of Study

Code No.: MSCS 251 *Full Mark*: 75

Paper: **Data Structure and Algorithms** *Pass Mark*: 30

Nature: Theory + Lab *Credit*: 3

Course description:

The aim of this course is to develop concepts of data structures and algorithms. The course helps the students to discover the concepts of data structures, different ADTs, recursion, tree, searching, sorting, graph and different algorithms.

Course objectives:

The main objective of this course is to provide students knowledge of different concepts of data structures, ADTs, and algorithms so that they will be able to implement these concepts in different fileds of computer science.

***Mode of Delivery*:**

The course will be taught by lecture (48 hrs), and lab work (24 hrs). The students are encouraged to develop computer programs related to the concepts of the C language after completion of each chapter.

***Course content*:**

Unit 1 Introduction to Data Structure **2 hrs**

Concept of data structure, Abstract Data Type, Implementation of Data structure

Unit 2 The Stack **4 hrs**

Definition, Stack as an ADT, POP and PUSH operation, Stack application: Evaluation of Infix, Postfix, and Prefix expressions

Unit 3 Queue **3 hrs**

Definition, Queue as an ADT, Primitive operations in queue, Linear and circular queue and their application, Enqueue and Dequeue

Unit 4 List **2 hrs**

Definition, Static and dynamic list structure, Array implementation of lists, Queues as list

Unit 5 Linked Lists **6 hrs**

Definition and link list as an ADT, Dynamic implementation, Basic operations in linked list: node insertion, deletion, insertion and deletion after and before nodes, Linked stacks and Queues, Doubly linked lists and its advantages

Unit 6 Recursion **4 hrs**

Principle of recursion, Comparison between recursion and iteration, Recursion example: TOH and Fibonacci sequence, Applications of recursion, Search tree

Unit 7 Trees **7 hrs**

Concept and definitions, Basic operation in Binary tree, Tree search and insertion/deletions, Binary tree traversals (pre-order, post-order and in-order), Tree height, level, and depth, Balanced trees: AVL balanced trees, Balancing algorithm

Unit 8 Sorting **6 hrs**

Insertion Sort, Selection Sort, Bubble Sort, Merge Sort, and Quick Sort, Efficiency of Sorting, Big 'O' Notation

Unit 9 Searching **6 hrs**

Search technique; essential of search, Sequential search, Binary search, Efficiency comparisons of different search technique

Unit 10 Graphs **8 hrs**

Representation and applications, Graphs as an ADT, Transitive closure, Warshall's algorithm, Graphs types, Graph traversal and Spanning forests, Kruskal's and Round-Robin algorithms, Shortest-path algorithm, Greedy algorithm, Dijkstra's Algorithm

Laboratory Work:

After completing this course, students should be able to implement all the concepts of data structures and algorithms in the syllabus using C/C++ programming language.

Reference Books:

1. Y. Langsam, M.J. Augenstein and A. M. Tenenbaum, Data Structures using C and C++ 2nd Edition
2. G. W. Rowe, Introduction to Data Structure and Algorithms with C and C++
3. Rajesh K. Shukla, Data Structures using C & C++

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