# Lectures for the course: Foundations of Computing Systems (IT60101)

## Week 1

### Lecture 1 – 21/07/2005

- Introduction to the course
- Background knowledge of students
- Planned topics

## Week 2

### Lecture 2 – 25/07/2005

- Insertion Sort
- Loop Invariant

### Lecture 3 (A+B) – 26/07/2005

- Time Complexity Analysis of Insertion Sort
- Selection Sort and Bubble Sort
- Assignments given on Time Invariant Definition of Selection Sort and Bubble Sort – due on 01/08/2005
- Assignments given on Implementation of Selection Sort and Bubble Sort on various data sets – due on 08/08/2005

## Week 3

### Lecture 4 (A+B) – 02/08/2005

- General Divide and Conquer technique
- Merge Sort
- Recurrence relation of Merge Sort
- Recurrence Tree construction
- Loop invariant in Merge Sort
- Growth of functions
- Theta Notation
- Time Complexity of algorithms in Theta Notations
- Assignment on Merge Sort given. Due date August $12^{th}$

## Week 4

**Lecture 5 (A+B) – 09/08/2005**

- Time Complexity of algorithms in O and Ω Notations
- O and ω notations
- Reflexive, Transitive and Symmetric properties of the sets of functions in O, θ and Ω.

## Week 5

**Lecture 6 (A+B) – 16/08/2005**

- Recurrence relations and methods of solving recurrences
- Substitution Method
- Recursion-Tree Method
- Master Theorem-based method

## Week 6

**Lecture 7 (A+B) – 23/08/2005**

- Data Structures
- Stacks, Queues, Linked Lists
- Linked Structure representation of Binary Trees and k-ary trees

## Week 7

**Lecture 8 (A+B) – 30/08/2005**

- Graphs – Basic Definitions
- Paths, Circuits and Cycles
- Tree
- Ordered Tree
- Binary Tree

## Week 8

**Lecture 9 (A+B) – 06/09/2005**

- Full Binary Tree and Complete Binary Tree
- Heap
- MAX HEAP and MIN HEAP
- HEAPIFY Algorithm
- Build Heap Algorithm
- Heapsort

- Assignment on heapsort given

**Week 9**

**Lecture 10 (A+B) – 13/09/2005**

- Quicksort
- Counting Sort
- Assignment on Quicksort and Counting Sort given

**Week 10**

**Lecture 11 (A+B) – 27/09/2005**

- Radix Sort
- Binary Search Trees
- In-order, Pre-order and Post-order traversals
- Finding Min and Max
- Successors and Predecessors

**Week 11**

**Lecture 12 (A+B) – 04/10/2005**

- BST – Insert and Delete
- Graph Algorithms - BFS

**Week 12**

**Lecture 13 (A+B) – 18/10/2005**

- DFS
- Minimum Spanning Tree
- Kruskal's Algorithm
- Prim's Algorithm

**Week 13**

**Lecture 14 (A+B) – 25/10/2005**

- Shortest Paths
- Bellman-Ford Algorithm
- Dijkstra's Algorithm

**Class Test 2 was held on 07/11/2005**

**Week 14**

**Lecture 15 (A+B) – 08/11/2005**

- Introduction to Dynamic Programming
- Basic definitions – P, NP and NP-complete
- Class test 2 scripts were shown
- Summary and feedback