

**Mathematical approach to Algorithms**

<b>Semester III</b>	<b>Subject Code: BS31603</b>	<b>Lectures: 60</b>
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**Objectives:**

The syllabus aims in equipping students with,

- Understanding concepts related to the design and analysis of algorithms
- Ability to understand and apply algorithms using greedy , divide and conquer approach
- Understanding graph theoretic algorithms with mathematical approach
- Mathematical approach to algorithm solving.
- Opportunity to study distribution of prime number and elementary primality algorithms.

<b>Unit 1: Introduction and Design</b>	<b>4</b>
<p><b>Chapter 1: Introduction to algorithm</b></p> <ul style="list-style-type: none"> <li>• Introduction to algorithm</li> <li>• Definition ,characteristics and examples</li> </ul> <p><b>Chapter 2 : Design strategies</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Types of strategies</li> <li>• Examples</li> </ul>	
<b>Unit 2: Divide and Conquer strategy</b>	<b>12</b>
<ul style="list-style-type: none"> <li>• Introduction to Divide and Conquer strategy.</li> <li>• Control abstraction</li> <li>• Binary search</li> <li>• Finding the Minimum and Maximum from the given list.</li> <li>• <math>K^{\text{th}}</math> smallest element from list</li> <li>• Convex hull</li> </ul>	



<b>Unit 3: Greedy Algorithm</b>	<b>14</b>
<ul style="list-style-type: none"> <li>• Introduction to greedy method</li> <li>• Control abstraction</li> <li>• Knapsack Problem</li> <li>• Job sequencing with dead line</li> <li>• Optimal storage on tapes</li> <li>• Optimal merge pattern</li> <li>• Huffman Code</li> <li>• All pairs shortest path.</li> </ul>	
<b>Unit 4: Graph theoretic algorithms</b>	<b>12</b>
<ul style="list-style-type: none"> <li>• BFS</li> <li>• DFS</li> <li>• Topological sorting</li> <li>• Strongly connected components</li> <li>• Numerical problems</li> </ul>	
<b>Unit 5: Algorithms on Prime numbers</b>	<b>06</b>
<ul style="list-style-type: none"> <li>• Definition and examples</li> <li>• Density of Prime numbers and Prime number theorem</li> <li>• Sieve of Eratosthenus test</li> <li>• Pseudo Prime(Definition and examples)</li> <li>• Miller-Rabin test</li> <li>• Solovey- Strassen's test and applications</li> </ul>	

**\*Contact hours – 12 hours**

**Reference Books:**

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, **Introduction to Algorithms** ,Third Edition, MIT Press
2. , Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, **Fundamentals of Computer Algorithms**, Galgotia publication pvt. Ltd.
3. David M. Burton, **Elementary Number theory-2nd edition**, - McGraw-Hill(Chapt 3-3.1 and 3.2)
4. Neil Koblitz, **A course in number theory and cryptography**, second edition, Springer
5. Dr.Prof. Nivedita Mahajan, **A first step in DAA**.

