

MSE1023 COMPUTABILITY AND COMPLEXITY THEORY

Module 1

Universal Models of Computation: Encoding Instances, Choosing a Model of Computation, Model Independence, Turing Machines as Acceptors and Enumerators.

Module 2

Computability Theory: Primitive recursive functions, Partial Recursive Functions, Encoding a Turing machine, Programming Systems, Recursive and R.E. Sets, Rice's Theorem and the Recursive Theorem, Degrees of Insolubility.

Module 3

Markov Algorithms: An Alternative Model of Sequential Machine, Markov Algorithms as Language Acceptors and as language Recognisers, Markov Algorithms as Computers of Number, Theoretic Functions, Labelled Markov Algorithms, The Class of Markov Computable Functions Is Identical to the class of Partial Recursive Functions, Considerations of Efficiency.

Module 4

Post Systems and Vector Machines: Post Systems and Formal Language, The Class of Post – Computable Functions, Is Identical to the class of Partial Recursive Functions, Closure Properties of the Class of Languages Generated by Post Systems, The class of Languages Generated by Post Systems Is Identical to the class of Turing – Acceptable Language, Language Recognition and Post Systems , Parallel Computation, Vectors and Vector Operations, Vector Machines, Vector Machines and Function Computation, Vector Machines and Formal Languages.

Module 5

Complexity Theory: Foundation Reducibility Among Problems, Reductions and Complexity Classes, Hierarchy Theorems, Model Independent Complexity Classes.
NP-Completeness: Cook's Theorem, Space Completeness, Intractable Problems.

Module 6

Proving Problems Hard: Important NP-Complete Problems, P-Completeness Proofs, Turing Reductions and Search Problems, The Polynomial Hierarchy, Enumeration Problems.

Module 7

Complexity Theory in Practice: Restrictions of Hard Problems, Promise Problems, Strong NP-Completeness, The Complexity Approximation, The Power of Randomization.

Text Books:

1. Bernard M. Moret – The Theory of Computation, Pearson Education, New Delhi, 2002.
2. R. Gregory Taylor – Models of Computation and Formal Languages, Oxford University Press, New York, 1998.