Program Name: **M.Tech in Computer Science & Engineering**

Specialization: **Information Security**

Aim:

With the ever increasing dependence of information for successful business operations, great emphasis is being laid on protecting business critical information. The scope of Information Security has been undefined and has been used in a customized manner in different contexts. This program aims to provide the basics of the complete end-to-end exposure from systems engineering, operating systems, computer networks and massive data mining, which will help the students to protect organization's business critical information from unauthorized external access.

Semester #1

Course Name: Logic and Combinatorics for Computer Science (3-1-0-0-8)

Unit 1: (10 Hours)

Language of Math Sets, relations, functions (quick review) - Logic: Propositional Logic, Predicate and First order Logic, Examples, Soundness and Completeness. Second Order Logic. Incompleteness theorems. Further extensions of logic (MSO, Temporal etc). Subsets of first order logic. Example Applications.

Unit 2: (8 hours)

Proofs: Mathematical Arguments and Argument Forms, Inference Rules, Notion of a Proof and validity of an argument, Various Proof techniques and examples, Identifying fallacies.

Unit 3: (10 hours)

Infinite Sets: Countable and uncountable sets, Cantors diagonalization. Undecidability: Turing Machines, Church-Turing Thesis. Notion of Computation and decidability, Undecidability of the Halting Problem. Consequences to the Program Verification Problem.

Unit 4: (20 Hours)

Counting and Combinatorics: Basics: Pigeonhole Principle and applications (quick review) . Counting methods: Principle of Inclusion Exclusion, Proving Combinatorial Identities, Combinatorial Arguments, Permutations, and Derangements. Recurrence: Linear recurrences, Generating Functions. Examples; Structured Sets: Posets and Lattices, Fixed Point Theorems (Knaster-Tarski and Polya), Monoids, Semigroups, Groupoids and Groups, Examples, Subgroups, Cosets, Lagrange's theorem. Introduction to Polyas theory of counting.

Text Books:

1) Name: Combinatorics: Topics, Techniques, Algorithms
   Chapters: Selected chapters as per the syllabus described
   Author: Peter J. Cameron
   Publishers: Cambridge University Press, 1994 (reprinted 1996)
   ISBN Number: 978-0-521-45761-3
2) Name: Discrete Mathematics and its Applications – 7th Edition
   Chapters: Selected chapters as per the syllabus described
   Author: Kenneth H. Rosen
   Publishers: Tata McGraw Hill Publishers - 2007
   ISBN Number: 978-0-07-338309-5
3) Name: Introduction to Automata Theory, Languages and Computation, 3rd Edition
   Chapters: Selected chapters as per the syllabus described
   Authors: Hopcroft, Motwani, and Ullman
   Publishers: Pearson Publishers, 2006
   ISBN Number: 978-0-321-45536-9