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| **Course-14 Title: Discrete Mathematics** |  |
| Course No.: **CIT 121** Credit : 3 Contact Hours: 3 | Total Marks: 100 |

**11.1 Rationale:**

To be a computer professional, one needs to have solid background on mathematical logic, number theory, functions and relations, graphs, trees.

**11.2 Objectives:**

Students will

* Explain mathematical logic and set theory deeply.
* Be able to apply number theory, functions and relations.
* Have in depth understanding of and be able to construct graphs and trees

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| **11.3**  **Learning Outcomes** | **11.4**  **Course Content** | **11.5**  **Teaching Strategy/ Learning Experience** | **11.6 Assessment Strategy** |
| * Describe logic * Apply logical operations * State and prove Normal Forms, Ordering Quantifiers, Predicates formulas. | **Mathematical Logic:** Statements and Notation. Connectives: Negation, Conjunction, Disjunction, Statement Formulas and Truth Tables. Conditional and Bi-conditional. Tautologies. Equivalence of Formulas. Duality Law. Tautological Implications. Functionally Complete Sets of Connectives. Normal Forms, Ordering and Uniqueness of Normal Forms. Rules of Inference. Methods of Proof. Predicate Calculus: Predicates, Statement Function, Variables, and Quantifiers, Predicate Formulas, Free and Bound Variables, The Universe of Discourse. Rules of Inference: Universal Specification, Existential Specification, Existential Generalization, and Universal Generalization. Mathematical Induction. | **Lecture**  **Exercise**  **Demonstration** | **Quiz**  **Short Answer**  **Assignment** |
| Apply and Analyze Modular Arithmetic and the Euclidean Algorithm. | **Elements of Number Theory:** Modular Arithmetic, and The Euclidean Algorithm. | **Lecture**  **Exercise**  **Demonstration** | **Quiz**  **Short Answer**  **Exercise** |
| * Describe Relation of function * Apply Properties of binary Relation Composition of binary relation, relation matrix * Determine celling function and Hashing function | **Relations and Functions:** Properties of Binary Relations, Composition of Binary Relations, Relation matrix and Graph of a Relation. Functions: Characteristic function, Floor function, Ceiling function and Hashing functions. | **Lecture**  **Exercise**  **Demonstration** | **Quiz**  **Short Answer**  **Assignment** |
| * Define Graph * Construct graph * Apply graph traversal techniques | **Graphs:** Introduction, definition and terminology, graph representations, traversals, connected components and spanning trees, shortest path and transitive closure, activity networks, topological sort and critical paths, enumerating all paths. | **Lecture**  **Exercise**  **Demonstration** | **Short Answer**  **Exercise** |
| * Identify Tree * Construct Tree * Analyze Tree | **Trees:** Basic terminology, Binary trees, binary tree representations, binary tree traversal; Binary search tree, tree search, Insert into a search tree, tree sort algorithm, deletion from a search tree, Building a binary search tree, Inserting a node, AVL trees, Forming a heap. | **Lecture**  **Exercise**  **Demonstration** | **Short Answer**  **Exercise** |
| * Identify groups | **Elements of Group Theory:** Semi groups, Isomorphism and Homomorphism of Semi groups, Groups, Group Homomorphism. | **Lecture**  **Exercise**  **Demonstration** | **Short Answer**  **Exercise** |

**Books Recommended:**

1. [Seymor Lipschutz](http://www.amazon.com/s/ref=ntt_athr_dp_sr_1?_encoding=UTF8&sort=relevancerank&search-alias=books&ie=UTF8&field-author=Seymor%20Lipschutz) and, Marc Lipson : Schaum's Outline of Discrete Mathematics

2.Rosen, K. H.: Discrete Mathematics and its Applications

3. Koleman & Busby : Discrete Mathematical Structures for Computer Science

4. Trembley & Manohar : Discrete Mathematical Structures with Applications to Computer Science