## SYLLABI OF CORE COURSES

### SEMESTER II

| Course Code | Type | Subject | L | T | P | Credits | CA | MS | ES | CA | ES | Pre-requisites |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CEC01 | CC | Discrete Structures | 3 | 1 | 0 | 4 | 25 | 25 | 50 | - | - | None |

COURSE OUTCOMES

1. To be able to analyze and compute time and space complexity of various computing problems.
2. To be able to design algorithms for solving various problems using the concepts of discrete mathematics.
3. To apply the concepts and algorithms learnt in developing large scale applications and modify them.

COURSE CONTENT

**Preliminaries**: Mathematical Logic, Propositions, Truth Tables, and Logical inferences, Predicates and quantifiers, Methods of Proof.

**Set Theory, Relations and Functions:** Elements of Set Theory, Primitives of set theory, binary Relation and its Representation, type of Binary Relations, Equivalence relations and partitions. Functions, Types of functions, Inverses and composition of Functions, Pigeon hole principle. Posets, Hasse Diagram, Lattices: Definition, Properties of lattices – Bounded, Complemented, Modular and Complete lattice, Boolean Algebra.

**Number Theory:** Infinity and Natural numbers, Integers, Divisibility and Euclidean algorithm, Prime numbers, Congruence, Modular arithmetic, Euler $\phi$ function, Public key cryptosystems and RSA.

**Counting:** Counting and analysis of algorithms, Permutations, Combinations, Asymptotic behavior of algorithms, Recurrence relation, generating functions

**Principles of Counting**: Principles of inclusion-exclusion, Pigeon hole principle, Permutations, Combinations.

**Mathematical induction:** proof by induction, Groups & rings, Recursion, Recurrence relation, Characteristic Polynomial. Generating Functions.

**Logic:** Propositional Logic, Logical Inference, First order logic, applications

**Graphs**: Graph isomorphism, Paths and Cycles, Graph coloring, Critical Path, Eulerian paths and circuits, Hamiltonian paths and circuits, Bipartite Graphs, Digraphs, Multigraphs.

**Probability:** Overview of probability theory , Discrete distributions.

SUGGESTED READINGS

1. Keneth H. Rosen, "Discrete Mathematics and Its Applications", TMH.
2. C.L. Liu, "Elements of Discrete Mathematics", TMH.
3. Kolman, Busby & Ross, "Discrete Mathematical Structures", PHI.
4. Narsingh Deo, "Graph Theory With Application to Engineering and Computer Science", PHI.
5. Charles S. Grimmstead, J. Laurie Snell "Introduction to Probability".
6. Kai Lai Chung, "A Course in probability theory".

| Course Code | Type | Subject | L | T | P | Credits | CA | MS | ES | CA | ES | Pre-requisites |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CEC02 | CC | Data Structures | 3 | 0 | 2 | 4 | 15 | 15 | 40 | 15 | 15 | None |

COURSE OUTCOMES

1. Candidate will be able to choose the appropriate data structure for a specified problem and determine the same in different scenarios of real world problems.
2. Become familiar with writing recursive methods and reducing larger problems recursively in smaller problems with applications to practical problems.
3. Be able to understand the abstract properties of various data structures such as