

Savitribai Phule Pune University Second Year of Computer Engineering (2015 Course) 210241: Discrete Mathematics		
Teaching Scheme: TH: 04 Hours/Week	Credit 04	Examination Scheme: In-Sem (online): 50 Marks End-Sem (paper): 50 Marks
Prerequisite:- Basic Mathematics		
Course Objectives: <ul style="list-style-type: none"> • To use appropriate set, function and relation models to understand practical examples, and interpret the associated operations and terminologies in context. • Determine number of logical possibilities of events. • Learn logic and proof techniques to expand mathematical maturity. • Formulate problems precisely, solve the problems, apply formal proof techniques, and explain the reasoning clearly. 		
Course Outcomes: On completion of the course, student will be able to– <ul style="list-style-type: none"> • Solve real world problems logically using appropriate set, function, and relation models and interpret the associated operations and terminologies in context. • Analyze and synthesize the real world problems using discrete mathematics. 		
Course Contents		
Unit I	Set Theory and Logic	09 Hours
Discrete Mathematics, Significance of Discrete Mathematics in Computer Engineering, Sets – Naïve Set Theory (Cantorian Set Theory), Axiomatic Set Theory, Need for Sets, Representation of Sets, Set Operations, cardinality of set, principle of inclusion and exclusion, Types of Sets – Countable and Uncountable Sets, Finite and Infinite Sets, Countably Infinite and Uncountably Infinite Sets. Introduction to bounded and unbounded sets and multiset. Countability of Rational Numbers Using Cantor Diagonalization Argument, power set. Propositional Logic - logic, Propositional Equivalences, Application of Propositional Logic-Translating English Sentences, Proof by Mathematical Induction and Strong Mathematical Induction.		
Unit II	Relations and Functions	09 Hours
Relations and Their Properties, n-ary Relations and Their Applications, Representing Relations , Closures of Relations, Equivalence Relations, Partial Orderings, partitions, Hasse Diagram, Lattices, Chains and Anti-Chains, Transitive Closure and Warshall’s Algorithm, n-Ary Relations and their Applications. Functions - Surjective, Injective and Bijective functions, Inverse Functions and Compositions of Functions, The Pigeonhole Principle.		

Unit III	Counting	09 Hours
The Basics of Counting, rule of Sum and Product, Permutations and Combinations, Binomial Coefficients and Identities, Generalized Permutations and Combinations, Algorithms for generating Permutations and Combinations.		
Unit IV	Graph Theory	09 Hours
Graphs and Graph Models, Graph Terminology and Special Types of Graphs, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Single source shortest path- Dijkstra's Algorithm, Planar Graphs, Graph Colouring. Case Study- Web Graph, Google map.		
Unit V	Trees	09 Hours
Introduction, properties of trees, Binary search tree, decision tree, prefix codes and Huffman coding, cut sets, Spanning Trees and Minimum Spanning Tree, Kruskal's and Prim's algorithms, The Max flow- Min Cut Theorem (Transport network). Case Study- Game Tree, Mini-Max Tree.		
Unit VI	Algebraic Structures and Coding Theory	09 Hours
The structure of algebra, Algebraic Systems, Semi Groups, Monoids, Groups, Homomorphism and Normal Subgroups, and congruence relations, Rings, Integral Domains and Fields, coding theory, Polynomial Rings and polynomial Codes, Case Study - Brief introduction to Galois Theory –Field Theory and Group Theory.		
Books:		
Text:		
<ol style="list-style-type: none"> 1. Kenneth H. Rosen, –Discrete Mathematics and its Applications”, Tata McGraw-Hill, ISBN 978-0-07-288008-3, 7th Edition. 2. C. L. Liu, –Elements of Discrete Mathematics”, TMH, ISBN 10:0-07-066913-9. 		
References:		
<ol style="list-style-type: none"> 1. Bernard Kolman, Robert C. Busby and Sharon Ross, –Discrete Mathematical Structures”, Prentice-Hall of India /Pearson, ISBN: 0132078457, 9780132078450. 2. N. Biggs, –Discrete Mathematics”, 3rd Edition, Oxford University Press, ISBN 0 –19 850717 – 8. 3. Narsingh Deo, –Graph with application to Engineering and Computer Science”, Prentice Hall of India, 1990, 0 – 87692 – 145 – 4. 4. Dr. K. D. Joshi, –Foundations of Discrete Mathematics”, New Age International Limited, Publishers, January 1996, ISBN: 8122408265, 9788122408263 5. C.D. Cantrell, –Modern Mathematical Methods for Engineers”, Cambridge University Press, ISBN-0521670497 6. Eric Gossett, –Discrete Mathematical Structures with Proofs”, Wiley India Ltd, ISBN:978-81-265-2758-8. 7. Sriram P & Steven S, –Computational Discrete Mathematics”, Cambridge University Press, ISBN 13: 978-0-521-73311-3. 		