Deccan Education Society's

FERGUSSON COLLEGE, PUNE

(AUTONOMOUS)

SYLLABUS UNDER AUTONOMY

FIRST YEAR B.Sc. (Computer Science)

SEMESTER – I

SYLLABUS FOR F.Y. B.Sc. (C.S.)

MATHEMATICS

Academic Year 2016-2017

Deccan Education Society's
FERGUSSON COLLEGE, PUNE
Scheme of Course Structure
(Faculty of Science)
Department of Mathematics
F.Y. B.Sc. (Computer Science)

Particulars	Paper Code	Title of Paper	No of Credits
Semester - I	MTC1101	Discrete Mathematics	2
	MTC1102	Algebra	2
	MTC1103	Mathematics Practical - I	2
Semester - II	MTC1201	Graph Theory	2
	MTC1202	Calculus	2
	MTC1203	Mathematics Practical - II	2

Learning Objectives:

- To develop problem solving abilities using a computer.
- To build the necessary skill set and analytical abilities for developing computer based solutions using mathematical concepts.
- To imbibe quality software development practices using Logical operations. To create awareness about process and product standards.
- To train students in professional skills related to Software Industry.

PAPER CODE: MTC1101 **PAPER - I: DISCRETE MATHEMATICS** **[Credit -2: No. of Lectures 36]**		
	Title and Contents	**No. of Lectures**
Bridge course	Revision: Propositional Logic, Propositional Equivalences. Predicates and Quantifiers: Predicate, *n*-Place Predicate or, *n*-ary Predicate, Quantification and Quantifiers, Universal Quantifier, Existential Quantifier, Quantifiers with restricted domains, Logical Equivalences involving Quantifiers. Rules of Inference: Argument in propositional Logic, Validity Argument (Direct and Indirect methods) Rules of Inference for Propositional Logic, Building Arguments.	**3**
Unit - I	**Lattices and Boolean Algebra** 1.1 Poset, Hasse diagram. 1.2 Lattices, Complemented lattice, Bounded lattice and Distributive lattice. 1.3 Boolean Functions: Introduction, Boolean variable, Boolean Function of degree n, Boolean identities, Definition of Boolean Algebra. 1.4 Representation of Boolean Functions. Minterm Maxterm Disjunctive normal form, Conjunctive normal Form. 1.5 Applications to Computer Science / Practical Application.	**10**
Unit - II	**Recurrence Relations** 2.1 Recurrence Introduction, Formation 2.2 Linear Recurrence Relations with constant coefficients. 2.3 Homogeneous Solutions. 2.4 Particular Solutions. 2.5 Total Solutions.(Introduction of Solving Recurrence Relation through generating functions)	**9**

	2.6 Applications to Computer Science / Practical Application.	
Unit - III	**Matrices and System of Linear Equations** 3.1 Revision: Elementary operations on matrices. 3.2 Echelon form of matrix 3.3 System of linear equations: Gauss Elimination Method, Gauss Jordan Elimination Method, L.U. Decomposition Method 3.4 Rank of matrix, Row rank, Column rank 3.5 Applications to Computer Science / Practical Application	**14**

References:

1) Kenneth Rosen, Discrete Mathematics and It's Applications (Tata McGraw Hill)

2) C. L. Liu ,Elements of Discrete Mathematics, (Tata McGraw Hill)

3) John Clark and Derek Holton, A First Look at Graph Theory (Allied Publishers)

4) Narsingh Deo, Graph Theory with Applications to Computer Science and Engineering, (Prentice)

PAPER CODE: MTC1102 **PAPER - II: ALGEBRA** **Credit - 2: No. of Lectures 36]**		
	Title and Contents	**No. of Lectures**
Unit - I	**Relations and Functions** 1.1 Ordered pairs, Cartesian product of Sets. 1.2 Relations, types of relations, equivalence relations. Partial orderings. 1.3 Equivalence Class, properties and partition of a set. 1.4 Transitive closure and Warshall's Algorithm. 1.5 Diagraphs of relations, matrix representation and composition of relations. 1.6 Definition of function as relation, types of functions (one-one, onto and bijective) 1.7 Pigeonhole principle. 1.8 Applications to Computer Science / Practical Application	**11**
Unit - II	**Divisibility in Integers** 2.1 Division Algorithm (without proof) 2.2 Divisibility and its properties, prime numbers. 2.3 Definition G.C.D and L.C.M., Expressing G.C.D. of two integers as a linear combination of the two integers. 2.4 Euclidean Algorithm (Without proof). 2.5 Relatively prime integers, Euclid Lemma and its generalization. 2.6 Congruence relations and its properties, Residue Classes: Definition, Examples, addition and multiplication modulo n and composition tables 2.7 Euler's and Fermat's Theorems. (Without proof). Examples 2.8 Chinese Remainder Theorem and its Applications. 2.9 Applications to Computer Science / Practical Application	**11**

Unit - III	**Binary Operations and Graphs** 3.1 Definitions of binary operations and properties of binary operations and examples. 3.2 Definition of groups ,examples Subgroups, finite and infinite group. 3.3 Permutation groups 3.4 Cyclic groups 3.5 Definition and Examples of Normal Subgroups 3.6 Definition and Examples of Quotient Groups. 3.7 Applications to Computer Science / Practical Application	**14**

References:

1) Discrete Mathematics Structure - Bernard Kolman, Robert Busby, Sharon Cutler Ross, Nadeem-ur-Rehman, Pearson Education, 5th Edition
2) Elements of Discrete Mathematics - C.L.Liu (Tata McGraw Hill)
3) Calculus and Analytical Geometry - Thomas Finny
4) J.B. Fraleigh, A. First Course in Abstract Algebra, Third Ed., Narosa, New Delhi, 1990
5) H. Anton and C. Rorres, Elementary Linear Algebra with Applications, Seventh Ed., Wiley, (1994).
6) Differential Equations with Applications and Historical notes- George Simmons

	PAPER CODE: MTC1103 **PAPER –III: MATHEMATICS PRACTICAL - I** **[Credit -2: No. of Practicals 10]**
	Title of Experiment / Practical
1	Introduction to Mathematical Programming Part-I
2	Introduction to Mathematical Programming Part-II
3	Lattices and Boolean Algebra.
4	Recurrence Relations.
5	Matrices and System of Linear Equations.
6	Relations and functions.
7	Binary Operations and Groups.
8	Divisibility in Integers.
9	Student activity - I
10	Student activity - II

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MATHEMATICS

Academic Year 2016-2017

PAPER CODE: MTC1201
PAPER –I: GRAPH THEORY
[Credit -2: No. of Lectures 36]

	Title and Contents	No. of Lectures
Unit - I	**Graphs** 1.1 Definition, Elementary terminologies and results, Graphs as Models. 1.2 Special types of graphs. 1.3 Isomorphism. 1.4 Adjacency and Incidence Matrix of a Graph. 1.5 Applications to Computer Science / Practical Application	**6**
Unit - II	**Operations on Graphs** 2.1 Subgraphs, induced sub-graphs, Vertex deletion, Edge deletion. 2.2 Complement of a graph and self-complementary graphs. 2.3 Union, Intersection and Product of graphs. 2.4 Fusion of vertices. 2.5 Applications to Computer Science / Practical Application	**4**
Unit - III	**Connected Graphs** 3.1 Walk, Trail, Path, Cycle: Definitions and elementary properties. 3.2 Connected Graphs: definition and properties. 3.3 Distance between two vertices, eccentricity, centre, radius and diameter of a graph. 3.4 Isthmus, Cut vertex: Definition and properties. 3.5 Cutset, edge-connectivity, vertex connectivity. 3.6 Weighted Graph and Dijkstra's Algorithm. 3.7 Applications to Computer Science / Practical Application.	**9**
Unit - IV	**Eulerian and Hamiltonian Graphs** 4.1 Seven Bridge Problem, Eulerian Graph, Definition and Examples. 4.2 Necessary and Sufficient condition. 4.3 Fleury's Algorithm. 4.4 Hamiltonian Graphs: Definition and Examples, Necessary Condition. 4.5 Introduction of Chinese Postman Problem and Travelling Salesman Problem. 4.6 Applications to Computer Science /	**5**

	Practical Application	
Unit - V	**Trees** 5.1 Definition, Properties of trees. 5.2 Center of a tree. 5.3 Binary Tree: Definition and properties. 5.4 Tree Traversal: Ordered rooted Tree, Preorder traversal, inorder traversal and postorder traversal, Prefix Notation. 5.5 Spanning Tree: Definition, Properties, Shortest Spanning Tree, Kruskal's Algorithm. 5.6 Applications to Computer Science / Practical Application	**6**
Unit - VI	**Directed Graphs** 6.1 Definition, Examples Elementary Terminologies and properties. 6.2 Special Types of Digraphs. 6.3 Connectedness of digraphs. 6.4 Network and Flows: definition and examples. 6.5 Activity on vertices**.** 6.6 Topological Sorting 6.7 Applications to Computer Science / Practical Application	**6**

References:

1. Kenneth Rosen, Discrete Mathematics and It's Applications (Tata McGraw Hill)
2. C. L. Liu ,Elements of Discrete Mathematics, (Tata McGraw Hill)
3 John Clark and Derek Holton, A First Look at Graph Theory (Allied Publishers)
4. Narsingh Deo, Graph Theory with Applications to Computer Science and Engineering, (Prentice)
5. D Knuth, Fundamentals of Algorithm Vol I.

PAPER CODE: MTC1202
PAPER - II: CALCULUS
[Credit -2: No. of Lectures 36]

	Title and Contents	No. of Lectures
Unit - I	**Continuity and Differentiability** 1.1 Continuity and Properties of continuous functions defined on [a, b] (Without proof) and examples. 1.2 Differentiability**.** 1.3 Theorem – Differentiability implies continuity but not conversely. Left hand derivative and Right hand derivative.. 1.4 Intermediate value theorem (without proof). 1.5 Rolle's theorem (with proof and geometric interpretation). 1.6 Lagrange's Mean Value Theorem (with proof and geometric interpretation) 1.7 Cauchy's Mean Value Theorem (with proof), Verification and applications. 1.8 L ' Hospital's Rule (without proof) 1.9 Growth of functions 1.10 Big O , Big Ω, little O , little Ω definition and examples 1.11 Applications to Computer Science / Practical Application	**14**
Unit - II	**Successive Differentiation** 2.1 The n^{th} derivatives of standard functions. 2.2 Leibnitz's Theorem (with proof). 2.3 Applications to Computer Science / Practical Application	**5**
Unit - III	**Taylor's and Maclaurin's Theorems** 3.1 Taylor's and Maclaurin's Theorems with Lagrange's and Cauchy's form of remainders (without proof). 3.2 Taylor's and Maclaurin's Series. 3.3 Applications to Computer Science / Practical Application	**5**
Unit - IV	**Ordinary differential equations** 4.1 Basic Concepts: Introduction, Definition, Direction Fields 4.2 First Order Differential Equations: Linear	**12**

	Differential Equations, Separable Differential Equations, Exact Differential Equations, Bernoulli Differential Equations, Substitutions, Euler's method, Intervals of Validity. 4.3 Second Order Differential Equations: Basic concepts, Real, distinct roots, complex roots, repeated roots, Reduction of order, Non-homogenous Differential Equations, Undetermined coefficients and Variation of parameters. 4.4 Applications to Computer Science / Practical Application	

References:

1) Discrete Mathematics Structure - Bernard Kolman, Robert Busby, Sharon Cutler Ross, Nadeem-ur-Rehman, Pearson Education, 5th Edition

2) Elements of Discrete Mathematics - C.L.Liu (Tata McGraw Hill)

3) Calculus and Analytical Geometry - Thomas Finny

4) J.B. Fraleigh, A. First Course in Abstract Algebra, Third Ed., Narosa, New Delhi, 1990

5) H. Anton and C. Rorres, Elementary Linear Algebra with Applications, Seventh Ed., Wiley, (1994).

6) Differential Equations with Applications and Historical notes- George Simmons.

7) Elementary Number Theory - Burton.

	PAPER CODE: MTC1203 **PAPER – III: MATHEMATICS PRACTICAL - II** **[Credit -2: No. of Practicals 10]**
	Title of Experiment / Practical
1	Graphs, Operations on Graphs and Connected Graphs
2	Eulerian and Hamiltonian Graphs.
3	Trees
4	Directed Graphs
5	Continuity and Differentiability.
6	Mean value theorems and L'Hospital rule.
7	Successive Differentiation and Taylor's and Maclaurin's Theorems.
8	Ordinary Differential Equations
9	Student activity - I
10	Student activity - II