B.C.S.Part I Mathematics (Sem.- I & II)

Syllabus to be implemented from June 2013 onwards.

1. TITLE: Subject Mathematics
2. YEAR OF IMPLEMENTATION : Revised Syllabus will be implemented from June 2013 onwards.
3. DURATION : B.C.S Part- I The duration of course shall be one year and Two semesters.
4. PATTERN: Pattern of examination will be semester.
5. STRUCTURE OF COURSE:

STRUCTURE OF COURSE
Mathematics (Semester I)

Sr. No	Paper	Name of Paper	Marks
1	Paper- I	Discrete Mathematics	50 (Theory)
2	Paper- II	Algebra	50 (Theory)

Mathematics (Semester II)

Sr. No	Paper	Name of Paper	Marks
1	Paper- III	Graph Theory	50 (Theory)
2	Paper- IV	Calculus	50 (Theory)

Practical (Annual)

Sr. No	Paper	Name of Paper	Marks
1	Practical I & II	Mathematics Practical I & II	100

EQUIVALENCE IN ACCORDANCE WITH TITLIES AND CONTENTS OF PAPERS (FOR REVISED SYLLABUS)

Sr. No.	Title of Old Paper	Title of New Paper
SEMESTER - I		
1	Discrete Mathematics	Discrete Mathematics
2	Algebra	Algebra
SEMESTER - II		
3	Graph theory	Graph theory
4	Calculus	Calculus
ANNUAL PATTERN		
5	Mathematics Practical I & II	Mathematics Practical I & II

B.C.S. Part-I Mathematics
Detail syllabus of semester I and II
Semester- I

Paper –I
(Discrete Mathematics)

Unit – 1 : Counting Principles **10 lectures**

1.1 Functions : Definition, Types of mapping , Injective, Surjective & Bijective functions, Inverse function, Composition of functions

1.2 Counting : Addition & Multiplication principle, Permutation and Combination

1.2.1 Cardinality of finite set.

1.1.2 Cardinality of union of sets (Addition principle)

1.1.3 Principle of Inclusion and Exclusion. Examples.

1.3 Combinatorial Arguments

1.4 Pigeonhole Principle(Statement only). Examples.

Unit – 2: Recurrence Relations **10 lectures**

2.1 Introduction

2.2 Linear Recurrence relation with constant coefficient

2.3 Homogeneous solutions

2.4 Particular and Total solutions

Unit – 3 : Logic **13 lectures**

3.1 Propositions and Logical connectives: Definition, Types of Propositions, Truth values and Truth Tables, Tautology and Contradiction, Logical equivalence

3.2 Rules of inferences

3.3 Valid arguments and proofs

3.4 Methods of Proofs : Direct and indirect

Unit – 4 Algorithms **12 lectures**

4.1 Definition

4.2 Pseudocode conventions

4.3 Examples
4.4 Characteristics of an algorithm
4.5 Time complexity.
Examples of type : Iterative, Recursion(e.g.Fibonnaci Sequence) Evaluation (e.g. Horner's Method),Searching Methods(Linear search, Binary search),Sorting Methods(Insertion sort, Merge Sort, Bubble Sort)

Reference Books:

1.Elements of Discrete Mathematics by C.L. Liu
2 Discrete Mathematics by Olympia Nicodemi
3 Discrete Mathematical Structure for Computer Science by Alan Doer and K.Levasicur.
4 Discrete and Combinatorial Mathematics by R.m. Grassl
5. Discrete Mathematics by Kenneth Rosen,Tata McGraw Hill
6. Discrete mathematics by S.R.Patil and others, NIRALI Prakashan.
7.Discrete mathematics by Bhopatkar, Nimbkar, Joglekar, VISION Publication.
8. Discrete mathematics by Naik and Patil, PHADAKE Prakashan

Paper- II
(ALGEBRA)

UNIT – 1 Relations **12 lectures**

1.1 Ordered pairs, Cartesian product
1.2 Relations, Types of relations, Equivalence relation, Partial ordering
1.3 Digraphs of relations, matrix representation and composition of relations
1.4 Transitive closure, Warshall's algorithm
1.5 Equivalence class, Partition of a set

UNIT – 2 Divisibility of integers **12 lectures**

2.1 Introduction
2.2 Divisibility : Division algorithm (Statement only)
2.3 Greatest Common Divisor (g.c.d.), Least Common Multiple (L.C.M)
2.4 Euclidean algorithm(Statement only)
2.5 Prime numbers, Euclides Lemma, Fundamental theorem of Arithmetic (without proof)
2.6 Congruence relation and its properties
2.7 Fermat's Theorem(Statement only). Examples.
2.8 Residue Classes: Definition, Examples, addition modulo n multiplication modulo n.

UNIT – 3 Boolean algebra **12 lectures**

3.1 Hasse digram
3.2 Lattice: Definition, principle of duality
3.3Basic properties of algebraic systems defined by Lattices

3.4 Distributive and complemented lattices
3.5 Boolean lattices and Boolean algebras
3.6 Boolean expressions and Boolean functions
3.7 Disjunctive and conjunctive normal forms and examples.

UNIT – 4 Abstact algebra **9 lectures**

4.1 Binary operation : Definition
4.2 Semi group and Monoids : Definition and examples
4.2 Group : Definition and examples.
4.2.1 Simple properties of groups
4.3 Sub - Group: Definition and examples

Reference Books:

1 Algebra by S.R.Patil and Others Nirali Prakashan.
2. Algebra by Bhopatkar, Nimbkar, Joglekar, VISION Publication.
3 Algebra by Naik and Patil, PHADAKE Prakashan

Practical – I

1. Recurrence relation
2. Linear Searching Methods
3. Combinatorial arguments
4. Euclid's algorithm, Division algorithm
5. Fermat's theorem on remainder
6. Warshall's algorithm
7. Disjunctive and Conjunctive normal forms of Boolean expression
8. Sorting Methods
9. Finite state machine,input tape output tape
10. Proofs of valid arguments using laws of inferences

Semester- II

Paper III
(GRAPH THEORY)

Unit – 1 : Graphs and operations on graphs **10 lectures**

1.1 Definition and elementary results
1.2 Types of graphs
1.3 Isomorphism
1.4 Matrix representation of graphs : Adjacency matrix and incidence matrix
1.5 Subgraphs and induced graphs
1.6 Complement of a graph, Self complementary graphs
1.7 Union, intersection of graphs, Ring sum of two graphs,

Unit – 2 Connected Graphs **10 lectures**

2.1 Definitions: walk, trail, tour, path and circuit,
2.2 Definitions of connected, disconnected graphs

2.3 Dijkstra's shortest path algorithm
2.4 Connectivity: Isthumus, cut-vertex, vertex connectivity.

Unit-3 : Tree Graphs **8 lectures**

3.1 Tree : Definition
3.1.1 Theorem : A tree with n vertices has n -1 edges.
3.1.2 Theorem : A connected graph G with n vertices and n – 1 edges is a tree
3.1.3 Theorem : A graph with n vertices is a tree if and only if it is circuit free and has n – 1 edges.
3.1.4 Theorem : A graph G is a tree if and only if it is minimally connected.
3.2 Center of a tree
3.3 Spanning tree: Definition and examples
3.4 Fundamental circuit and cut – set : Definition
3.5 Binary trees and elementary results
3.6 Kruskal's algorithm.

Unit - 4 : Directed Graphs **12 lectures**

4.1 Definition, types of directed graphs
4.2 Directed (rooted) trees, arborescence and Polish notation
4.3 Isomorphism of digraphs
4.4 Connectedness in digraphs
4.5 Euler digraph
4.6 Network and flows: Definition, examples.
4.7 Maximal flow algorithm.

Reference Books:

1.Elements of Discrete Mathematics by C.L. Liu
2 Discrete Mathematics by Olympia Nicodemi
3 Discrete Mathematical Structure for Computer Science by Alan Doer and K.Levasicur.
4 Discrete and Combinatorial Mathematics by R.m. Grassl
5. Discrete Mathematics by Kenneth Rosen,Tata McGraw Hill
6. Graph Theory with Applications to Computer Science and Engineering by Narsing Deo, Prentice Hall, India
7. A First Step in Graph Theory by Raghunathan, Nimkar and Solapurrkar
8. Discrete mathematics by S.R.Patil and others, NIRALI Prakashan.
9. Discrete mathematics by Bhopatkar, Nimbkar, Joglekar, VISION Publication.
10. Discrete mathematics by Naik and Patil, PHADAKE Prakashan

Paper- IV

Paper IV
(CALCULUS)

UNIT – 1 Sequences of real numbers **10 lectures**

1.1 Sequences of real numbers : Definition, examples
1.2 Convergent, divergent, oscillatory sequences Definition and examples
1.3 Bounded sequence : Definition and examples
1.4 Monotonic sequences. Theorems on monotonic and bounded sequences(statements only)
1.5 Show that sequence $<(1+1/n)^n>$ is convergent and its limit is ' e '.
1.6 Convergence of sequence $< x^n >$, where $x \in R, x > 0$.

UNIT – 2 Series of real numbers **8 lectures**

2.1 Partial sums
2.2 Converget, Divergent series. Definition and examples
2.3 Convergence of geometric series(with proof).
2.4 Comparison Test and its limit form (for the series of positive terms)
2.5 Convergence of p – series (with proof).
2.6 D'Alembert's Ratio Test (statement only) and examples.
2.7 Root Test (statement only) and examples.

UNIT-3 Continuity and Mean valueTheorems: **10 lectures**

3.1 Continuity of a function and its properties defined on [a,b] (Properties without proof)
3.2 Differentiability. Differentiabilty implies continuity but not conversely.
3.3 Rolle's theorem(with proof) and its geometric significance and examples
3.4 Lagrange's Mean Value theorem(with proof) and its geometric significance and examples.
3.5 Cauchy's Mean Value theorem (with proof) and examples.

UNIT-4 Successive Differentiation: **6 lectures**

4.1 n^{th} derivatives of some standerd functions.
4.2 Leibnitz's Theorem (with proof) and examples.
4.3 L'Hospital's Rule (without proof) and examples
4.4 Taylor's and Maclaurin's Theorems with Lagrange's and Cauchy's forms of Remainders (without proof)
4.5 Taylor's and Maclaurin's series
4.6 Series expansions of e^x, sinx, cosx, log(1 + x) etc.

Reference Books:

1. Calculus by Dr. S.B. Nimse
2. Mathematical Analysis : Malik and Arrora
3. Real Analysis by R.G. Bartle,D.Sherbert, 3rd Edn, John Wiley & Sons, Indian Edn.
4. Differential Calculus by Shanti Narayan, S.Chand& Co.
5. A text book of Calculus and Differential equations by Dinde H. T. , Lokhande A.D.etc. SUMS publication.

Practical – II

11. Kruskal's algorithm
12. Dijkstra's Shortest path algorithm
13. Fundamental curcit and fundamental cut set
14. Polish prefix, Postfix, notations, arborescence
15. Rolle's Theorem
16. Lagrange's Maean Value Theorem
17. Cauchy's Maean Value Theorem
18. Series expansion of $\log(1+x)$, e^x, sinx, cosx, $(1+x)^n$
19. L'Hospital's Rule
20. Leibnitz's Rule

Nature of Question Paper (Theory)

Q.1.	Multiple Choice based objective type questions (four options for each question be given)	8 Marks
Q.2.	Attempt any two of the following (out of three)	16 Marks
Q. 3.	Attempt any four of the following (out of six)	16 Marks
	Total	40 Marks