

**University of Mumbai**  
**B.Sc. (Computer Science)**

**Syllabus**

**S.Y.BSc. (W.E.F. 2004-05)**

## B.SC. COMPUTER SCIENCE

### Year II

<b>Discrete Mathematics</b>	<b>Paper I – Section I</b>
<b>Computer Graphics-I</b>	<b>Paper I – Section II</b>
<b>C++ and JAVA</b>	<b>Paper II – Section I</b>
<b>Data structures</b>	<b>Paper II – Section II</b>
<b>GUI and Visual Basic</b>	<b>Paper III – Section I</b>
<b>Data Base Management</b>	<b>Paper III – Section II</b>

**Total Lectures / Subject = 80 / Year, TERM I = 40, TERM II = 40**

#### **Examination Pattern for II<sup>nd</sup> Year of B Sc Computer Science**

**Marks of Theory paper per Term = 50 converted to 30**  
**Marks of Practical per paper per Year = 40 converted to 40**  
**Total marks per paper per year will be 30 + 30 + 40 = 100**

## B Sc. Computer Science: YEAR II

### Paper I

<b>CLASS: B. Sc (Computer Science)</b>		<b>Year II</b>	
<b>SUBJECT: Discrete Mathematics Paper I : Section I Computer Graphics -I Paper I : Section II</b>			
<b>Periods per week ( 1 Period = 50 minutes )</b>	<b>Lecture</b>	<b>3</b>	
	<b>Practical</b>	<b>3</b>	
		<b>Hours</b>	<b>Marks</b>
<b>Evaluation System</b>	<b>Theory Examination per Term per Section</b>	<b>3</b>	<b>50</b>
	<b>Practical per year</b>	<b>--</b>	<b>40</b>

### SECTION I

1. Fundamentals – Sets and subsets, Operations on sets, Sequences, Division in the integers, Mathematical structures.
2. Logic – Propositions and Logical operations, Conditional Statements, Methods of proof, mathematical induction.
3. Counting – Permutations, Combinations, The pigeonhole principle, elements of probability, recurrence relations.
4. Relations and Digraphs – Product sets and partitions, relations and digraphs, paths in relations and digraphs, properties of relations, equivalence relations, computer representation of relations and digraphs, manipulation of relations, Transitive closure and Warshalls algorithm.
5. Functions – Functions for computer science, permutation functions, growth of functions
6. Semi groups and groups – Binary operations, semi groups, products and quotients of semi groups, groups, Products and quotients of groups.
7. Languages and finite state machines – Languages, representation of special languages and grammars, Finite state machines, Semi groups , machines and languages, machines and regular languages.
8. Groups and coding – Coding of binary information and error detection  
Decoding and error correction.

#### Reference :

Discrete structures by B Kolman RC Busby, S Ross PHI Pvt. Ltd.

Discrete structures by Liu

Digital Logic John M Yarbrough Brooks/cole, Thompson Learning

Discrete Mathematics and its Applications Kenneth H. Rosen TMG

Discrete Mathematics for computer scientists and Mathematicians, Joe L.Mott, Abraham Kandel Theodore P. Baker, Prentice-Hall of India pvt ltd

Discrete Mathematics With Applications, Susanna S. Epp, Books/Cole Publishing Company

Discrete Mathematilcs, Schaum's Outlines Series, Seymour Lipschutz, Marc Lipson, TMG

## SECTION II

### Computer Graphics - I

1. Introduction, What is computer graphics? Elements of graphics workstation, Video Display Devices- Raster Scan Systems, Random Scan Systems, Input Devices, Graphics Software Coordinate Representations, Fundamental problems in Geometry.
2. Algorithms: Line drawing algorithms- DDA Algorithm, Bresenham's Line Algorithm, Frame Buffers, Circle and ellipse generating algorithms- Midpoint Circle Algorithm, Midpoint Ellipse Algorithm, Polynomials and spline curves, Filling- Filled Area Primitives, Scan-Line Polygon Fill Algorithm, Inside-Outside Tests, Scan-Line Fill of Curved Boundary Areas, Boundary-Fill Algorithm, Flood-Fill Algorithm, Character Generation, Attributes of lines, curves, filling, characters etc.
3. Graphics Primitives, Primitive Operations, The Display-File Interpreter- Normalized Device Coordinates, Display-File Structure, Display-File Algorithms, Display Control, Polygons- Polygon Representation.
4. Attributes of Output Primitives, Line Attributes- Line Type, Line Width, Pen and Brush Options, Line Color, Color and Grayscale levels- Color Tables, Grayscale, Area-Fill Attributes- Fill Styles, Pattern Fill, Soft Fill, Character Attributes, Text Attributes.
5. Geometric Transformations: Matrices, Scaling Transformations- Sin and Cos Rotation, Homogeneous Coordinates and Translation, Coordinate Translations, Rotation about an arbitrary point, Inverse Transformations, Transformation Routines.
6. 2 D Viewing, The viewing pipeline, Viewing Coordinate Reference Frame, Window-to-viewport Coordinate Transformation, Two-Dimensional Viewing Functions, Clipping Operations- Point Clipping, Line Clipping, Cohen-Sutherland Line Clipping, Polygon Clipping, Sutherland-Hodgeman Polygon Clipping.
7. 3 D Concepts: Three-Dimensional Display Methods- Parallel Projection, Perspective Projection, Visible Line and surface Identification, Surface Rendering, Three-Dimensional Object Representations- Bezier Curves and surfaces, B-Spline Curves and surfaces

#### Reference:

Computer Graphics, Donald Hearn & M. Pauline Baker, Prentice Hall of India  
Computer Graphics, Steven Harrington, McGraw-Hill  
Computer Graphics(Schaum's Outline Series), Roy A. Plastock, Tata McGraw-Hill  
Principles of Interactive Computer Graphics, Willaim M. Newman, Robert F. Sproull, McGraw-Hill.  
Introduction to Computer Graphics, J.D. Foley, A. Van Dam, S.K. Feiner, J.F. Hughes & R.L. Phillips, Addison Wesley  
Computer Graphics by Rogers

\*\*\*\*\* END OF PAPER I \*\*\*\*\*

<b>CLASS: B. Sc (Computer Science)</b>		<b>Year II</b>	
<b>SUBJECT: C++ and JAVA</b>		<b>Paper II : Section I</b>	
<b>Data Structures using C / C++</b>		<b>Paper II : Section II</b>	
<b>Periods per week ( 1 Period = 50 minutes )</b>	<b>Lecture</b>	<b>3</b>	
	<b>Practical</b>	<b>3</b>	
		<b>Hours</b>	<b>Marks</b>
<b>Evaluation System</b>	<b>Theory Examination per Term per Section</b>	<b>3</b>	<b>50</b>
	<b>Practical per year</b>	<b>--</b>	<b>40</b>

### SECTION I

C++

**1. Revision of C++ fundamentals:**

**Object oriented programming using C++, Classes and Objects:**

**2. Object Initialization and Cleanup:**

**Constructors, Parameterized constructors, Destructor, Constructor overloading, Constructors with default arguments, Constructors with dynamic operations**

**Function and Operator Overloading:**

**Function overloading, functions with default arguments, Inline functions, Unary operator overloading, Operator returning value, Binary operator overloading, Overloading arithmetic, relational and assignment operators.**

**3. Inheritance:**

**Derived and base class, protected members, Overriding functions, Private, protected and public inheritance, Derived class constructors, Levels of inheritance and multiple inheritance**

**4. Virtual Functions and Polymorphism:**

**Virtual Functions, Pure Virtual Functions, Abstract Classes, Using Virtual Functions, Early verses Late binding**

**5. Arrays, Pointers and References:**

**Array of Objects, Initialized and Uninitialized Arrays, Pointer to Object, “this” pointer, Pointer to derived types, Pointer to Class Member, Reference Parameters, Passing Reference to Objects, Returning References, Independent References, Dynamic Allocation Operators, Allocating Objects**

**6. Introduction to JAVA:**

**Java - Data Types, variables, Arrays, Operators.**

**Control Statements, Introducing Classes, Inheritance, Packages and Interfaces, Exception Handling, Multithreaded Programming, I/O Applets, String Handling, Exploring java. lang, Java. util, Java. I/O, Networking, Introduction to HTML Applets, Event Handling**

**Reference:**

**Object Oriented programming using C++, E. Balaguruswamy, TMH**

**Complete reference to C++ by Herbert shield TMH**

**Let us C++ by Yaswant Kanetkar BPB**

**Starting out with C++ by Tony Gaddis PENRAM International Publishing(India)**

**Practical C++ Programing O'Reilly**

**Beginning C++, Ivor Horton**

**A first book of C++, Gary Bronson**

**Practical C++ programming, Steve Oualline Shroff Publishers**

**Teach Yourself C++ Herbert Schildt, TMG**

**Object Oriented design in c++ using STL, Nicholas J De Lillo, Brooks/Cole, Thompson Learning**

**Object oriented Programming in C++, Nabajyoti Barkakati, Prentice-Hall of India pvt ltd**

**Object Oriented Programming Using C++, Joyce Farrell, Course Technology Thompson Learning**

**Patric Naughton, JAVA handbook, TMH, (Ch. 2-6,7,9,10,13,15)**

**Object oriented Programming with C++ and JAVA, D.Samantha, Prentice-Hall of India pvt ltd**

## **SECTION II**

**Data Structures using C / C++:**

- 1. Definition of Data Structure, Data structure and analysis of Algorithms  
Classification of Data Structures  
Storage Structures: Sequential and Linked**
- 2. Linear Data Structures:  
Arrays and their memory representations  
Queues, Circular Queue, Deque, Priority Queue  
Stacks and their representation, application to recursion.  
Linked Lists and their representation: singly, doubly, circular. Operations and applications: Implementation, Insertion, Deletion, and Concatenation, merging and reversing.  
Sparse matrix and its representation & implementation.**
- 3. Trees and their representations, binary trees and their operations such as traversal, threading.**
- 4. Graphs: Definition and terminology, sorting and searching techniques.**
- 5. Hashing: Hash table, hashing function.**

**References:**

**Kruse,Leung,Tondo, "Data structures and Program Design in C", Prentice Hall**

**Aho,Hopcroft, Ullman, "Data Structures and Algorithms", Addison-Wesley.**

**Knuth 'Fundamentals of Algorithms' (Narosa Publication)**

**Horowitz, Sahni, "Fundamentals of Data Structures, Computer Science Press.**

**\*\*\*\*\* END OF PAPER II \*\*\*\*\***

<b>CLASS: B. Sc (Computer Science)</b>		<b>Year II</b>	
<b>SUBJECT: GUI and Visual Basic</b>		<b>Paper III: Section I</b>	
<b>Data Base Management</b>		<b>Paper III: Section II</b>	
<b>Periods per week ( 1 Period = 50 minutes )</b>	<b>Lecture</b>	<b>3</b>	
	<b>Practical</b>	<b>3</b>	
		<b>Hours</b>	<b>Marks</b>
<b>Evaluation System</b>	<b>Theory Examination per Term per Section</b>	<b>3</b>	<b>50</b>
	<b>Practical per year</b>	<b>--</b>	<b>40</b>

## SECTION I

### 1. G U I

Murphy's law of G U I Design, Features of G U I, Icons and graphics, Identifying visual cues, clear communication, color selection, GUI standard, planning GUI Design Work.

Visual programming

Software Component Mindset-role of programming code

### 2. Introduction to Visual Basic

Introduction Graphical User Interface (GUI), Programming Language (Procedural, Object Oriented, Event Driven), The Visual Basic Environment, How to use VB compiler to compile / debug and run the programs.

VB Controls

Textboxes, command buttons, Frames, Check Boxes , Option Buttons, Images, Setting a Border & Styles, The Shape Control, The line Control, Working with multiple controls and their properties, Designing the User Interface, Keyboard access, tab controls, Default & Cancel property, Coding for controls.

### 3. Variables, Constants, and Calculations

Variables, Variables Public, Private, Static, Constants, Data Types, Naming rules/conventions, Constants, Named & intrinsic, Declaring variables, Scope of variables, Val Function, Arithmetic Operations, Formatting Data.

### 4. Decision & Conditions

If Statement, If –then-else Statement, Comparing Strings, Compound Conditions(And, Or, Not), Nested If Statements, Case Structure ,Using If statements with Option Buttons & Check Boxes, Displaying Message in Message Box, Testing whether Input is valid or not.

Using Call Statement to call a procedure.

### 5. Menus, Sub-Procedures and Sub-functions

Defining / Creating and Modifying a Menu, Using common dialog box, Creating a new sub-procedure, Passing Variables to Procedures, Passing Argument ByVal or ByRef, Writing a Function Procedure,

### 6. Multiple Forms

Creating, adding, removing Forms in project, Hide, Show Method, Load, Unload Statement, Me Keyword, Referring to Objects on a Different Forms,

### 7. List, Loops and Printing

List Boxes & Combo Boxes, Filling the List using Property window / AddItem Method, Clear Method, List box Properties, Removing an item from a list, List Box/ Combo Box, Do/Loops, For/Next Loops, Using MsgBox Function, Using String Function, Printing to printer using Print Method,

### 8. Arrays

Single-Dimension Arrays, Initializing an Array using for Each, User-Defined Data Types, Accessing Information with User-Defined Data Types, Using List Boxes with Array, Two dimensional arrays.

## **9. Data Files**

**Opening and Closing Data Files, The Free File Function, Viewing the data in a file, Sequential File Organization (Writing Data to a sequential Disk File, Creating a sequential data file, Reading the Data in a sequential file, Finding the end of a Data file, Locating a file). Trapping Program Errors, The Err Object, Random Data File Opening a random file, Reading and writing a random file(Get, Put, LOF, Seek).**

## **10. Accessing Database File**

**Creating the database files for use by Visual Basic(Using MS-Access), Using the Data Control ,setting its property, Using Data Control with forms, navigating the database in code ( the recordset object using the movenext, moveprevious, movefirst & movelast methods , checking for BOF & EOF, using listboxes & comboboxes as data bound controls, updating a database file ( adding, deleting records ) .**

## **11. Advanced data handling**

**Displaying data in grids ( grid control, properties of grid ) , displaying the record no & record count, opening the database, validation & error trappings ( locking text boxes, trap errors with On Error, file open errors ) , Recordset , searching for a specific record ( findfirst, findnext, findlast, findprevious,) , seek method, working with database fields, creating a new dynaset.**

### **Books:**

- i) Programming in VB 6 by Julia case Bradley , Anita C. Millsbaugh, TMH**
- ii) Visual Basic 6.0 Programming by Content Development Group, TMH**
- iii) The Complete Reference Visual Basic 6 by Noel Jerke , TMH**

## **SECTION II**

### **Data base concepts and Systems**

**1. Introduction- Purpose of Database Systems, Views of data, Data Models, Database language, Transaction Management, Storage Management, Database Administrator, Database Users, Overall System Structure, Different types of Database Systems**

**2. E-R Model: Basic Concepts, Design Issues, Mapping Constraints, Keys, E-R Diagram, Weak Entity set, Extended E-R features, Design Of an E-R Database Schema, Reduction of an E-R schema to Tables**

**3. Relational Model: Structure of Relational Database, The Relational Algebra, The tuple relational calculus, The Domain Relational Calculus, Views**

**4. SQL- Background, Basic Structure, SET operations, Aggregate functions, Null Values, Nested Sub queries, Derived Relations, Views, Modification of Database, Joined Relations, DDL, Other SQL features**

**5. Transaction- Transaction Concepts, State, Implementations of Atomicity and durability, Concurrent Executions, Serializability, Recoverability, Transaction Definition in SQL. Concurrency Control- Lock based protocol, Timestamp based protocol, Validation based protocol, Multiple Granularity, Multi version Schemes, Deadlock Handling, Insert and Delete operations, Concurrency in index structure.**

### **Query Optimization**

**6. Relational Database Design- Pitfalls in Relational-Database Design, Decomposition, Normalization Using Functional Dependencies, and Normalization Using Multi valued Dependencies, Normalization Using Join Dependencies, Domain-Key Normal Form and Alternative Approaches to Database Design**



**7. Introduction to SQL: The SQL language, role of SQL, SQL features & benefits, SQL Standards ( ANSI / ISO Standards, other SQL standards, ODBC & the SQL access group) , SQL & networking ( centralized architecture, file server architecture , client/server architecture, multi-tier architecture)**

**RDBMS: Data models (File management systems, hierarchical databases, network databases), relational data model ( Keys, tables, relationships), Codd's 12 rules**

**SQL Basics: statements, names ( table & column names), data types , constants (numeric, string, date & time, symbolic constants), expressions , built-in functions, missing data (NULL values)**

**Simple queries: The SELECT statement , query results, simple queries, duplicate rows, row selection, search conditions, sorting query results, rules for single table query processing**

**Multi-table queries : Simple joins , Non equi-joins, SQL considerations for multi table queries ( table aliases, qualified column names, all column selections , self joins) , multi table query performance , the structure of the join ( table multiplication, rules for multi-table query processing ) , outer joins**

**Summary Queries : column functions, grouped queries, group search conditions**

**Sub queries & query expressions : using sub queries, sub query search conditions, sub queries & joins, nested sub queries , correlated sub queries, sub queries in the HAVING clause.**

**Books:**

- 1. Database Systems and Concepts, Henry F. Korth, Sliberschatz, Sudarshan, McGraw Hill**
- 2. DBMS by Date**
- 3. Visual Basic 6 programing Bible, Eric Smith, IDG Books India Pvt. Ltd.**
- 4. Visual basic 6 Programing Black Book, Steven Holzner, IDG Books India Pvt. Ltd.**
- 5. GUI Design for dummies, IDG books.**
- 6. SQL Server 2000 Black Book, Patrick Dalton, IDG Books India Pvt. Ltd.**
- 7. Visual Basic6 Programming Blue Book by Peter G. Aitken—Technology Press**
- 8. The complete reference SQL by James R. Groff & Paul N. Weinberg TMG**
- 9. SQL a complete reference by Alexis Leon & Mathews Leon TMG**
- 10. Microsoft SQL Server 7.0 Bjeletich,S.: Mable. G. Techmedia**

**References:**

**Using visual basic 6 / Reselman, Rob: Peasley, R.: Pruchniak Prentice Hall India pvt.ltd**

**Visual Basic 6 : In Record Time/ Brown, S. B P B Publication**

**Beginning S Q L Server 2000 for Visual Basic Developers Willis thearon Shroff publishers & distributors**

**Fundamentals of Database Systems, Elmasri and Navathe**

**An Introduction to Database System, C.J. Date**

**Principles of Database System, Ullman, Galgotia Publications**

**Oracle Client Server Computing, BPB Publications**

**Database Management Systems Majumdar/ A K Bhattacharyya, Tata Mc Graw Hill**

**Object Oriented Database Management, Kemper and Moerkotte, Prentice Hall New Jersey**

**Object Oriented MultiDatabase System, Omran A. Bukhares & A.K Elmagarmid, Prentice Hall Inc.1996**

**\*\*\*\*\* END OF PAPER III \*\*\*\*\***

## **GENERAL INSTRUCTIONS FOR CONDUCT OF REGULAR PRACTICAL**

1. In order to take the practical a lab session similar to the given practical can be taken to initiate the thinking required for the practical.
2. **At least fourteen practicals (seven from each section)** should be completed in a year. The practicals TAKEN should be recorded in a journal maintained for the purpose. The concerned teacher and the head of the department should certify the said journal.

### **List of practicals/ tutorials/term work for Paper I**

#### **Paper I: Section I**

- Practical 1: Problem solving session on **topic 1**
- Practical 2: Problem solving session on **topic 2**
- Practical 3: Problem solving session on **topic 3**
- Practical 4: Problem solving session on **topic 4**
- Practical 5: Problem solving session on **topic 5**
- Practical 6: Problem solving session on **topic 6**
- Practical 7: Problem solving session on **topic 7**
- Practical 8: Problem solving session on **topic 8**

#### **Paper I: Section II**

- Practical 9: Working in C Graphics. Functions/Methods used in C Graphics.
- Practical 10: DDA Line drawing algorithm
- Practical 11: Bresenham's line drawing algorithm
- Practical 12: Midpoint circle algorithm
- Practical 13: Midpoint-ellipse algorithm
- Practical 14: Polygon generation
- Practical 15: Polygon filling
- Practical 16: Animation using different line and pixel methods
- Practical 17: Clipping algorithms
- Practical 18: Creation of bezier / B-splines.

### **List of practicals/ tutorials/term work for Paper II**

#### **Paper II: Section I**

##### **C++**

- Practical 1: Simple programs to revise C++ fundamentals
- Practical 2: Constructor and constructor overloading, function overloading
- Practical 3: Operators and operator overloading
- Practical 4: Inheritance, multiple inheritances
- Practical 5: Virtual Functions and Polymorphism:
- Practical 6: Arrays, Pointers and References:

##### **JAVA**

- Practical 7: Introductory concepts and working on JAVA
- Practical 8: Concept of a Java class, which includes encapsulation, inheritance, polymorphism etc.
- Practical 9: Demonstration of the concept of a Java package and its interfaces.
- Practical 10: Java string handling, string sorting, concatenation, subtraction and comparison.

## **Paper II: Section II**

### **JAVA**

- Practical 11: Java error conditions using exception handling.  
Practical 12: Use of Java input / output as a set of stream classes.  
Practical 13: Java Applet on the Internet/ Intranet.

### **Linear Data Structures**

- Practical 14: Arrays and their memory representation
- Practical 15: }  
Practical 16: } Queues, Circular Queue, Deque, Priority Queue
- Practical 17: Stacks and their representation, application to recursion.
- Practical 18: }  
Practical 19: } Linked Lists  
Operations and applications: Implementation, Insertion, Deletion, and Concatenation, merging and reversing.
- Practical 20: Sparse matrix and its representation & implementation.  
Practical 21: Tree traversal  
Practical 22: Graphing algorithms

<b><u>List of practicals/ tutorials/term work for Paper III</u></b>
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### **Paper III – Section I**

- Practical 1: }  
Practical 2: } Use of different controls used in VB.  
Practical 3: }
- Practical 4: Use of different message boxes and statements used in VB  
Practical 5: Menus, Sub-Procedures and Sub-functions  
Practical 6: Multiple Forms  
Practical 7: Use of List Boxes & Combo Boxes, Filling the List using Property window / AddItem Method, Clear Method, List box Properties, Removing an item from a list, List Box/ Combo Box, Using String Function, Printing to printer using Print Method,  
Practical 8: Use and working of Data Files  
Practical 9: Accessing Database File  
Practical 10: Advanced data handling

### **Paper III – Section II**

- Practical 11: Write simple single table SQL queries using operators with select columns and restricting rows of output. More complex single table queries. Ordering queries and using sub-queries. Multitable queries using the join operators. Equi-joins and outer joins. Non-Equi-joins with inequalities in the join condition.
- Practical 12: Queries using single row numeric, character, data formatting and other complex formatting.
- Practical 13: Queries with aggregate functions, subtotals and selection on subtotal rows. Generate a correlated subquery.
- Practical 14: Create views and update them.
- Practical 15: Creating tables with defaults, integrity constraints, referential integrity

constraints and check constraints both at the column level and table level. Inserting data in table structures and deleting tables.

Practical 16: Updating tables, altering table structures and deleting tables.

Practical 17: Simple reporting by formatting column headers and columns of output. Using top titles and bottom titles. Printing the report.

Practical 18: Storing SQL and formatting statements in command files. Executing command files and printing the reports.