TELANGANA UNIVERSITY
NIZAMABAD-503322

B.Sc. Computer Science Syllabus
Under the

CHOICE BASED CREDIT SYSTEM
(With effect from 2017-18)

DEPARTMENT OF COMPUTER SCIENCE
University College,TU,Nizamabad-503322

Contents

Syllabus for Computer Science

Proposed scheme for **B.Sc**. Programme under Choice Based Credit System

Code	Course Title	Course Type	HpW	Credits
	SEMESTER – I			
BS106	Programming in C	DSC-3A	4T+2P=6	4+1=5
	SEMESTER – II			
BS206	Object Oriented Programming with C++	DSC-3B	4T+2P=6	4+1=5
	SEMESTER – III			
BS301	A: SciLab - 1	SEC-1	2T	2
	B: Boolean Algebra			
BS306	Data Structures and File Processing	DSC-3C	4T+2P	4+1=5
	SEMESTER – IV			
BS401	C:Scilab-2	SEC-2	2T	2
	D: Digital Logic			
BS406	Database Management Systems	DSC-3D	4T+2P=6	4+1=5
	SEMESTER – V			
BS501	Information Technologies-1	GE-1	2T	2
BS502	E: Discrete Structures-1	SEC-3	2T	2
	F: Computer Organization			
BS505	Programming in Java	DSC-3E	3T+2P=5	3+1=4
BS506	Elective-A: Operating Systems	DSE-1A	3T+2P=5	3+1=4
	Elective-B: Software Engineering	DSE-2A		
	Elective-C:Data Mining	DSE-3A		
	SEMESTER – VI			
BS601	Information Technologies-2	GE-2	2T	2
BS602	G: Discrete Structures-2	SEC-4	2T	2
	H: Information Security			
BS605	Web Programming	DSC-3F	3T+2P=5	3+1=4
BS606	Elective-A: PHP with MySQL	DSE-1B	3T+2P=5	3+1=4
	Elective-B: Computer Graphics	DSE-2B		
	Elective-C: Computer Networks	DSE-3B		
			Total Number of Credits	48

DSC-3A   Programming in C   BS106

Theory   4 Hours/Week   4 credits

Unit – I

Computer Fundamentals : Introduction of Computers, Classification of Computers, Anatomy of a
computer, Memory Hierarchy, Introduction to OS, Operational Overview of a CPU.
Program Fundamentals : Generation and Classification of Programming Languages, Compiling,
Interpreting, Loading, Linking of a Program, Developing Program, Software Development.
Algorithms : Definitions, Different Ways of Stating Algorithms (Step-form, Pseudo-code, Flowchart), Strategy
for Designing Algorithms, Structured Programming Concept.
Basics of C : Overview of C, Developing Programs in C, Parts of Simple C Program, Structure of a C
Program, Comments, Program Statements, C Tokens, Keywords, Identifiers, Data Types, Variables,
Constants,Operators and Expressions, Expression Evaluation–precedence and associativity, Type Conversions.

Unit – II

Input-Output   : Non-formatted and Formatted Input and Output Functions, Escape Sequences.
Control Statements : Selection Statements – if, if-else, nested if, nested if-else, comma operator, conditional
operator, switch; Iterative Statements–while, for, do-while; Special Control Statement–goto, break, continue,
return, exit.
Arrays and Strings : One-dimensional Arrays, Character Arrays, Functions from ctype.h,
string.h, Multidimensional Arrays.

Unit – III

Functions : Concept of Function, Using Functions, Call-by-Value Vs Call-by-reference, Passing Arrays
to Functions, Score of Variables, Storage Classes, Inline Functions, and Recursion.
Pointers : Introduction, Address of Operator (&), Pointer, Uses of Pointers, Arrays and Pointers, Pointers
and Strings, Pointers to Pointers, Array of Pointers, Pointer to Array, Dynamic Memory Allocation.

Unit – IV

User-defined Data Types : Declaring a Structure (Union) and its members, Initialization Structure (Union),
Accessing members of a Structure (Union), Array of Structures (Union), Structures verses Unions,
Enumeration Types.
Files : Introduction, Using Files in C, Working with Text Files, Working with Binary Files, Files of Records,
Random Access to Files of Records, Other File Management Functions.

Text   Pradip Dey, Manas Ghosh, Computer Fundamentals and Programming in C (2e)

References
   1.   Ivor Horton, Beginning C
   2.   Ashok Kamthane, Programming in C
   3.   Herbert Schildt, The Complete Reference C
   4.   Paul Deitel, Harvey Deitel, C How To Program
   5.   Byron S. Gottfried, Theory and Problems of Programming with C
   6.   Brian W. Kernighan, Dennis M. Ritchie, The C Programming Language
   7.   B. A. Forouzan, R. F. Gilberg, A Structured Programming Approach Using C

C Lab   BS106
Practical   2 Hours/Week   1 credit

1 .Write a program to find the largest two (three) numbers using if and conditional operator.

2 .Write a program to print the reverse of a given number.

3 .Write a program to print the prime number from 2 to n where n is given by user.

4 .Write a program to find the roots of a quadratic equation using switch statement.

5 .Write a program to print a triangle of stars as follows (take number of lines from user):

```
        *
      * * *
    * * * * *
  * * * * * * *
* * * * * * * * *
```

6 .Write a program to find largest and smallest elements in a given list of numbers.

7 .Write a program to find the product of two matrices..

8 .Write a program to find the GCD of two numbers using iteration and recursion.

9 .Write a program to illustrate use of storage classes.

10. Write a program to demonstrate the call by value and the call by reference concepts.

11 .Write a program that prints a table indicating the number of occurrences of each alphabet in the text entered as command line arguments.

12 .Write a program to illustrate use of data type enum.

13 .Write a program to demonstrate use of string functions string.h header file.

14 .Write a program that opens a file and counts the number of characters in a file.

15 .Write a program to create a structure Student containing fields for Roll No., Name, Class, Year and Total Marks. Create 10 students and store them in a file.

16 .Write a program that opens an existing text file and copies it to a new text file with all lowercase letters changed to capital letters and all other characters unchanged.

Note:
- Write the Pseudo Code and draw Flow Chart for the above programs.
- All the concepts of programs from Text Book including exercises must be practiced, executed and written down in the practical record book.
- Faculty must take care about UG standard programs it should be minimum 25 – 30.
- In the external lab examination student has to execute at least three programs with compilation and deployment steps as necessary.
- External Viva-voce is compulsory.

DSC-3B   Object Oriented Programming with C++   BS206

Theory	4 Hours/Week	4 credits
Practical	2 Hours/Week	1 credit

Unit I

Introduction to C++ : structure of C++ program, creating the source file, compiling and linking ,Tokens, Keywords, Identifiers and Constants , Basic Data types, User defined Data types, storage classes, Derived data types, Operators in C++,Arrays, Strings.
Functions in C++: Introduction, The main function, Function Prototyping, Call by Reference, Return by reference, Inline Functions, Recursion, , Function Overloading, Friend and Virtual functions.
Principles of Object Oriented Programming : A look at Procedure oriented programming, Object oriented programming paradigm, Basic concepts of Object Oriented Programming , Benefits of OOP, Object oriented languages, Applications of OOP.

Unit II

Classes and Objects : Specifying a Class, Defining member functions, making an Outside function inline, Nesting of member functions, Private member functions, Memory allocation for Objects , Static Data members, Static Member Functions, Arrays Of Objects, Objects as function arguments, returning objects, Pointers to members, Local Classes.
Constructors and Destructors: Introduction, Constructors , Parameterized Constructors, Multiple constructors in a class, Constructor with default arguments , Dynamic initialization of Objects, Copy Constructor, Dynamic Constructors , Destructors.
Operator overloading and Type Conversions : Defining Operator Overloading, Overloading Unary Operators, Overloading Binary Operators, Rules for Operator Overloading , Type Conversions.

Unit III

Inheritance : Introduction , Defining Derived Classes , Single Inheritance, Multi level Inheritance, Multiple Inheritance, Hierarchical Inheritance, Hybrid Inheritance, Virtual Base Classes , Abstract Classes, Constructors in derived classes, Nesting of classes.
Virtual functions and polymorphism : Virtual Functions, Pure Virtual Functions, Virtual Constructors and Destructors.
Managing Console I/O operations : C++ streams, C++ stream classes, Unformatted I/O Operations, Formatted console I/O Operations.

Unit IV

Templates : Introduction, Class templates , Function templates, Class templates with multiple parameters , Function templates with multiple parameters, Overloading of Template Functions.
Exception handling : Introduction, Exception handling mechanism , Throwing and Catching an Exception, Re-throwing an Exception , Exceptions in Constructors and Destructors, Introduction to the Standard Template Library .

Text Book:
>   E. Balagurusamy "Object Oriented Programming with C++" TMH, 6th edition, 2013.

Recommended Books :
1. Reema Thareja "Object Oriented Programming with C++" Oxford university Press, 2015
2. Richard Johnson, *An Introduction to Object-Oriented Application Development*, Thomson Learning, 2006
3. B. Stroustrup, *The C++ Programming Language*, Addison Wesley, 2004.
4. Herbert Schildt, C++: The Complete Reference
5. Spoken Tutorial on "C++" as E-resource for Learning:- http://spoken-tutorial.org

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C++ Lab   BS206
Practical   2 Hours/Week   1 credit

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1 Write a program to.

a. Print the sum of digits of a given number.

b. Check whether the given number is Armstrong or not

c. Print the prime number from 2 to n where n is natural number given.

2. Write a program to find largest and smallest elements in a given list of numbers and sort the given list.

3 .Write a program to read the student name, roll no, marks and display the same using class and object.

4 Write a program to implement the dynamic memory allocation and de-allocation using new and delete operators using class and object.

5 .Write a program to find area of a rectangle, circle, and square using constructors.

6. Write a program to implement copy constructor.

7. Write a program using friend functions and friend class.

8 .Write a program to implement constructors

- Default Constructor, Parameterized Constructor, Copy Constructor

- Define the constructor inside/outside of the class

- Implement all three constructors within a single class as well as use multiple classes(individual classes)

9. Write a program to implement the following concepts using class and object

- Function overloading
- Operator overloading (unary/binary(+ and -))

10. Write a program to demonstrate single inheritance, multilevel inheritance and multiple inheritances.

11 .Write a program to implement the overloaded constructors in inheritance.

12. Write a program to implement the polymorphism and the following concepts using class and object.

- Virtual functions
- Pure virtual functions

13. Write a program to demonstrate inline functions

14. Write a program to demonstrate static polymorphism using method overloading.

15. Write a program to demonstrate dynamic polymorphism using method overriding and dynamic method dispatch.

16. Write a program to implement the template (generic) concepts

- Without template class and object
- With template class and object

Note:

- Write the Pseudo Code and draw Flow Chart for the above programs.

- All the concepts of programs from Text Book including exercises must be practiced, executed and written down in the practical record book.

- Faculty must take care about UG standard programs it should be minimum 25 – 30.

- In the external lab examination student has to execute at least three programs with compilation and deployment steps as necessary.

- External Viva-voce is compulsory.

SEC–1 [A] SciLab – 1 BS301

Theory 2 Hours/Week 2 credits

Unit – I

Introduction to Scilab – what is scilab, downloading & installing scilab, a quick taste of scilab.
The Scilab Environment – manipulating the command line, working directory, comments, variables in memory, recording sessions, the scilab menu bar, demos.
Scalars & Vectors – introduction, initializing vectors in scilab, mathematical operations on vectors, relational operations on vectors, logical operations on vectors, built-in logical functions.

Unit – II

Scalars & Vectors – elementary mathematical functions, mathematical functions on scalars, complex numbers, trigonometric functions, inverse trigonometric functions, hyperbolic functions.
Matrices – introduction, arithmetic operators for matrices, basic matrix processing.
Polynomials – introduction, creating polynomials, basic polynomial commands, finding roots of polynomial, polynomial arithmetic, miscellaneous polynomial handling.

Text   Er. Hema Ramachandran, Dr. Achuthsankar S. Nair, Computer SCILAB–A Free Software to

MATLAB

References
1. Digite, Introduction to Scilab
2. Digite, Optimization in Scilab
3. Scilab Enterprises, Scilab for Very Beginners
4. Digite, Introduction to Discrete Probabilities with Scilab

Note:
Student friendly video lecturers pertaining to this course are
available at http://spoken-tutorial.org/

SEC–1[B]   Boolean Algebra   BS301
                Theory   2 Hours/Week   2 credits

Unit – I

Introduction Number Systems and Conversion: Digital Systems and Switching Circuits, Number Systems and Conversion, Binary Arithmetic, Representation of Negative Numbers, Binary Codes.
Boolean Algebra : Basic Operations, Boolean Expressions and Truth Tables, Basic Theorems, Commutative, Associative, Distributive, and DeMorgan's Laws, Simplification Theorems, Multiplying Out and Factoring, Complementing Boolean Expressions.

Unit – II

Boolean Algebra: Multiplying Out and Factoring Expressions, Exclusive-OR and Equivalence Operations, The Consensus Theorem, Algebraic Simplification of Switching Expressions, Proving Validity of an Equation, Programmed Exercises.
Applications of Boolean Algebra Minterm and Maxterm Expansions: Conversion of English Sentences to Boolean Equations: Combinational Logic Design Using a Truth Table, Minterm and Maxterm Expansions, General Minterm and Maxterm Expansions, Examples of Truth Table Construction, Design of Binary Adders and Subtracters.

Text   Charles H. Roth, Jr. and Larry L. Kinney, Fundamentals of Logic Design (7e)

References

        1.M. Morris Mano, Michael D. Ciletti, Digital Design (4e)
        2.A. Saha and N. Manna, Digital Principles and Logic Design
        3.M. Rafiquzzaman, Fundamentals of Digital Logic and Microcontrollers (6e)
        4.Elliott Mendelson, Theory and Problems of Boolean Algebra and Switching Circuit
        5.M. Morris Mano, Charles R. Kime, Tom Martin, Logic and Computer Design Fundamentals

DSC-3C   Data Structures and File Processing   BS306

       Theory   4 Hours/Week   4 credits
       Practical   2 Hours/Week   1 credit

Unit I

Basic data Structure : Introduction to Data Structures, Types of Data Structures, Introduction to Algorithms, Pseudo code, and Relationship among data, data structures, and algorithms, Implementation of data structures, Analysis of Algorithms.
Stacks : Concept of Stacks and Queues, Primitive Operations, Stack Abstract Data Type, Representation of Stacks Using Sequential Organization (Arrays), Applications of Stack, Expression Evaluation and Conversion, Polish notation and expression conversion, Processing of Function Calls, Reversing a String with a Stack, Checking Correctness of Well-formed Parentheses, Recursion.

Unit II

Recursion : Introduction, Recurrence, Use of Stack in Recursion, Variants of Recursion, Recursive Functions, Iteration versus Recursion.
Queues : Concept of Queues, Queue as Abstract Data Type, Realization of Queues Using Arrays, Circular Queue, Multi-queues, Deque, Priority Queue, Applications of Queues,
Linked Lists : Introduction, Linked List, Linked List Abstract Data Type, Linked List Variants, Doubly Linked List, Circular Linked List.

Unit III

Trees : Introduction, Types of Trees, Binary Tree, Binary Tree Abstract Data Type, Realization of a Binary Tree, Insertion of a Node in Binary Tree, Binary Tree Traversals- Preorder, In order, Post order Traversals.

Searching and Sorting : Searching, Sequential search, Binary search, Types of sorting, Bubble sort, Insertion sort, Selection sort, Quick sort, Merge sort, Comparison of All Sorting Methods.

Unit IV

Hashing : Introduction, Key Terms and Issues, Hash Functions, Collision Resolution Strategies.
Heaps : Basic Concepts, Implementation of Heap, Heap as Abstract Data Type, Heap Applications, Heap Sort. *Files* : Introduction, External Storage Devices, File Organization, Sequential File Organization, Direct Access File Organization, Indexed Sequential File Organization, Linked Organization.

Text books:
1. Varsha H. Patil " Data structures using C++" Oxford university press, 2012
2. M.T. Goodrich, R. Tamassia and D. Mount, *Data Structures and Algorithms in C++*, John Wiley and Sons, Inc., 2011.

Recommended Books

1. Adam Drozdek "Data structures and algorithm in C++" Second edition, 2001
2. T.H. Cormen, C.E. Leiserson, R.L. Rivest and C. Stein, *Introduction to Algorithms,* 2nd Ed., Prentice-Hall of India, 2006.
3. Robert L. Kruse and A.J. Ryba, *Data Structures and Program Design in C++*, Prentice Hall, Inc., NJ, 1998.
4. B. Stroupstrup, *The C++ Programming Language*, Addison Wesley, 2004
5. D.E. Knuth, *Fundamental Algorithms* (Vol. I), Addison Wesley, 1997

Data Structures and File Processing Lab   BS306

Practical   2 Hours/Week   1 credit

1. Write C++ programs to implement the following using an array
a) Stack ADT   b) Queue ADT

2. Write a C++ program to implement Circular queue using array.

3. Write a program to create a single linked list and write functions to implement the following operations.
a) Insert an element at a specified position   b) Delete a specified element in the list
c) Search for an element and find its position in the list   d) Sort the elements in the list ascending order

4. Write a program to create a double linked list and write functions to implement the following operations.
a) Insert an element at a specified position   b) Delete a specified element in the list
c) Search for an element and find its position in the list   d) Sort the elements in the list ascending order

5. Write a program to create singular circular linked lists and function to implement the following operations.
a) Insert an element at a specified position b) Delete a specified element in the list c) Search for an element and find its position in the list

6. Write C++ programs to implement the following using linked list
 a) Stack ADT   b) Queue ADT

7.Write a C++ program to implement Circular queue using Single linked list.

8. Write a C++ program to implement the double ended queue ADT using double linked list.

9. Write a C++ program to solve tower of hanoi problem recursively .

10.Write a program to convert the given infix expression to postfix expression using stack.

11. Write a program to evaluate a postfix expression using stack.

12. Write a C++ program that uses non-recursive functions to traverse a binary tree.
 a)Pre-order   b)In-order   c)Post-order

13. Write a C++ program to find height of a tree.
14. Write C++ programs for sorting a given list of elements in ascending order using the following sorting methods.

a)Bubble sort   b) Selection sort

15. Write C++ programs for sorting a given list of elements in ascending order using the following sorting methods. a)Quick sort b)Merge sort

16. Write C++ programs for sorting a given list of elements in ascending order using the following sorting methods. a)Heap sort b)Insertion sort

NOTE:
- All the concepts of programs from Text Book including exercises must be practiced, executed and written down in the practical record book.
- Faculty must take care about UG standard programs it should be minimum 25 – 30.
- In the external lab examination student has to execute at least three programs with compilation and deployment steps as necessary.
- External Viva-voce is compulsory.

SEC–2 [A]   SciLab – 2   BS401
                    Theory   2 Hours/Week   2 credits

Unit – I

Programming in scilab – introduction, variables & variable names, assignment statements, arithmetic, relational, logical operators, input & output, flow control/branching/conditional statements, break and continue, handling matrices with loops, scripts, the concept of functions, user defined functions, special function commands.
Menus and Dialog Boxes – introduction, a simple menu example, scilab window with greetings menu added, executing submenus from command line, linking menus to scilab code from external files, entering data through dialog boxes, printing a message in a message box, dialog box for entering a matrix.

Unit – II

Graphic Output – introduction, 2d plotting, function versions for graphic commands, 3d plotting, other graphic primitives, other graphic commands.
String Handling Functions – symbolic processing in scilab, creation of a linear combination of arguments, string to ASCII conversion, creation of a string of blank characters, conversion of a string to uppercase and lowercase, string matching, string concatenation, reversing a string, replacement of a string by another, length of a string, type checking.
Statistics – introduction, basic statistical functions, applying statistical functions on matrices, distributions, frequency of values of a matrix or vector, centre, weighted centre, central moment, correlation, covariance, variance matrix, percentiles, frequencies, cumulative sum, difference of two independent samples, fisher test.

Text   Er. Hema Ramachandran, Dr. Achuthsankar S. Nair, Computer SCILAB–A Free Software to MATLAB

References

1. Digite, Introduction to Scilab
2. Digite, Optimization in Scilab
3. Scilab Enterprises, Scilab for Very Beginners
4. Digite, Introduction to Discrete Probabilities with Scilab

SEC–2 [B]   Digital Logic   BS401
                  Theory   2 Hours/Week   2 credits

Unit – I

Karnaugh Maps: Minimum Forms of Switching Functions, Two- and Three-Variable Karnaugh Maps, Four-Variable Karnaugh Maps, Determination of Minimum Expressions Using Essential Prime Implicants, Other Uses of Karnaugh Maps, Other Forms of Karnaugh Maps, Programmed Exercises.
Multi-Level Gate Circuits NAND and NOR Gates: Multi-Level Gate Circuits, NAND and NOR Gates, Design of Two-Level NAND- and NOR-Gate Circuits, Design of Multi-Level NAND- and NOR-Gate Circuits, Circuit Conversion Using Alternative Gate Symbols, Design of Two-Level, Multiple-Output Circuits, Multiple-Output NAND- and NOR-Gate Circuits.

Unit – II

Combinational Circuit Design and Simulation Using Gates: Design of Circuits with Limited Gate Fan-In, Gate Delays and Timing Diagrams, Hazards in Combinational Logic, Simulation and Testing of Logic Circuits.
Multiplexers, Decoders: Multiplexers, Three-State Buffers, Decoders and Encoders, Read-Only Memories.

Text   Charles H. Roth, Jr. and Larry L. Kinney, Fundamentals of Logic Design (7e)

References
                1.M. Morris Mano, Michael D. Ciletti, Digital Design (4e)
                2.A. Saha and N. Manna, Digital Principles and Logic Design
                3.M. Rafiquzzaman, Fundamentals of Digital Logic and Microcontrollers (6e)
                4.Elliott Mendelson, Theory and Problems of Boolean Algebra and Switching Circuit
                5.M. Morris Mano, Charles R. Kime, Tom Martin, Logic and Computer Design Fundamentals

DSC-3D   Database Management Systems   BS401

| Theory | 4 Hours/Week | 4 credits |
| Practical | 2 Hours/Week | 1 credit |

Unit I

Introduction: Database-System Applications, Purpose of Database Systems, View of Data, Database Languages, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Database Users and Administrators.
Introduction to the Relational Model: Structure of Relational Databases, Database Schema, Keys, Schema Diagrams, Relational Query Languages, Relational Operations.

Unit II

Introduction to SQL: Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Subqueries, Modification of the Database.
Intermediate SQL: Join Expressions, Views, Transactions, Integrity Constraints, SQL Data Types and Schemas, Authorization.
Advanced SQL: Accessing SQL From a Programming Language, Functions and Procedures, Triggers, Recursive Queries.

Unit III

Database Design and the E-R Model: Overview of the Design Process, The Entity-Relationship Model, Constraints, Removing Redundant Attributes in Entity Sets, Entity-Relationship Diagrams, Reduction to Relational Schemas, Entity-Relationship Design Issues, Extended E-R Features, Alternative Notations for Modeling Data, Other Aspects of Database Design.
Relational Database Design: Features of Good Relational Designs, Atomic Domains and First Normal Form, Decomposition Using Functional Dependencies, Functional-Dependency Theory, Decomposition Using Multivalued Dependencies, More Normal Forms, Database-Design Process.

Unit IV

Transaction management : Transaction Concept, A Simple Transaction Model, Storage Structure, Transaction Atomicity and Durability, Transaction Isolation , Serializability, Transaction Isolation and Atomicity, Transaction Isolation Levels, Implementation of Isolation Levels, Transactions as SQL Statements.
Concurrency Control: Lock-Based Protocols , Deadlock Handling, Multiple Granularity, Timestamp-Based Protocols , Validation-Based Protocols , Multiversion Schemes , Snapshot Isolation, Insert Operations, Delete Operations, and Predicate Reads, Concurrency in Index Structures .

Text book:

1. A. Silberschatz, H. Korth and S. Sudarshan, *Database System Concepts,* 6th Ed., Tata McGraw Hill,

2011 References:

1. J. Morrison, M. Morrison and R. Conrad, *Guide to Oracle 10g*, Thomson Learning, 2005.
2. Loney and Koch, *Oracle 10g: The Complete Reference*, Tata McGraw Hill, 2006.
3. David Flanagan, Java Script, *The Definitive Guide*, O'Reilly Media, 2006.
4. Marty Hall, Larry Brown, and Yaakov Chaikin, *Core Servlets and Java Server Pages: Core Technologies* (Vol. II), 2nd Ed., Sun Microsystems Press, 2006.
5. S.K. Singh, *Database Systems Concepts, Design and Applications*, Pearson Education 2006.
6. Spoken Tutorial on "MySQL" as E-resource for Learning:- http://spoken-tutorial.org

Practical   2 Hours/Week   1 credit

1. Create a database having two tables with the specified fields, to computerize a library system of a Delhi University College.

LibraryBooks (Accession number, Title, Author, Department, PurchaseDate, Price)
IssuedBooks (Accession number, Borrower)
a) Identify primary and foreign keys. Create the tables and insert at least 5 records in each table.
b) Delete the record of book titled "Database System Concepts".
c) Change the Department of the book titled "Discrete Maths" to "CS".
d) List all books that belong to "CS" department.
e) List all books that belong to "CS" department and are written by author "Navathe".
f) List all computer (Department="CS") that have been issued.
g) List all books which have a price less than 500 or purchased between "01/01/1999" and "01/01/2004".

2. Create a database having three tables to store the details of students of Computer Department in your college.

Personal information about Student (College roll number, Name of student, Date of birth, Address, Marks(rounded off to whole number) in percentage at 10 + 2, Phone number) Paper Details (Paper code, Name of the Paper)
Student's Academic and Attendance details (College roll number, Paper code, Attendance, Marks in home examination).
a) Identify primary and foreign keys. Create the tables and insert at least 5 records in each table.
b) Design a query that will return the records (from the second table) along with the name of student from the first table, related to students who have more than 75% attendance and more than 60% marks in paper 2.
c) List all students who live in "Delhi" and have marks greater than 60 in paper 1.
d) Find the total attendance and total marks obtained by each student.
e) List the name of student who has got the highest marks in paper 2.

3. Create the following tables and answer the queries given below:

Customer (CustID, email, Name, Phone, ReferrerID)
Bicycle (BicycleID, DatePurchased, Color, CustID, ModelNo)
BicycleModel (ModelNo, Manufacturer, Style)
Service (StartDate, BicycleID, EndDate)
a) Identify primary and foreign keys. Create the tables and insert at least 5 records in each table.
b) List all the customers who have the bicycles manufactured by manufacturer "Honda".
c) List the bicycles purchased by the customers who have been referred by customer "C1".
d) List the manufacturer of red colored bicycles.
e) List the models of the bicycles given for service.

4. Create the following tables, enter at least 5 records in each table and answer the queries given below.

EMPLOYEE (Person_Name, Street, City)
WORKS (Person_Name, Company_Name, Salary)
COMPANY (Company_Name, City)
MANAGES (Person_Name, Manager_Name)
a) Identify primary and foreign keys.
b) Alter table employee, add a column "email" of type varchar(20).
c) Find the name of all managers who work for both Samba Bank and NCB Bank.
d) Find the names, street address and cities of residence and salary of all employees who work for "Samba Bank" and earn more than $10,000.

e) Find the names of all employees who live in the same city as the company for which they work.

f) Find the highest salary, lowest salary and average salary paid by each company.

g) Find the sum of salary and number of employees in each company.

h) Find the name of the company that pays highest salary.

5. Create the following tables, enter at least 5 records in each table and answer the queries given below.

Suppliers (SNo, Sname, Status, SCity)
Parts (PNo, Pname, Colour, Weight, City)
Project (JNo, Jname, Jcity)
Shipment (Sno, Pno, Jno, Qunatity)

a) Identify primary and foreign keys.

b) Get supplier numbers for suppliers in Paris with status>20.

c) Get suppliers details for suppliers who supply part P2. Display the supplier list in increasing order
of supplier numbers.

d) Get suppliers names for suppliers who do not supply part P2.

e) For each shipment get full shipment details, including total shipment weights.

f) Get all the shipments where the quantity is in the range 300 to 750 inclusive.

g) Get part nos. for parts that either weigh more than 16 pounds or are supplied by suppliers S2, or both.

h) Get the names of cities that store more than five red parts.

i) Get full details of parts supplied by a supplier in Delhi.

j) Get part numbers for part supplied by a supplier in Allahabad to a project in Chennai.

k) Get the total number of project supplied by a supplier (say, S1).

l) Get the total quantity of a part (say, P1) supplied by a supplier (say, S1).

NOTE:

- All the concepts of programs from Text Book including exercises must be practiced, executed and written
down in the practical record book.

- Faculty must take care about UG standard programs it should be minimum 25 – 30.

- In practical examination, students have to
  • Create database
  • Create tables with their integrity constraints.
  • Insert the data into tables and then execute the queries.
  • Answer any six queries from ten queries given by the examiner.
- External Viva-voce is compulsory.

GE–1   Information Technologies – 1   BS501
               Theory   2 Hours/Week   2 credits

Unit – I

Introduction to Computers: What is a Computer? Characteristics of Computers, Generations of
Computers, Classification of Computers, Basic Computer Organization, Applications of Computers.
Input and Output Devices: Input Devices, Output Devices, Soft Copy Devices, Hard Copy Devices. *Computer
Memory and Processors*: introduction, Memory Hierarchy, Processor Registers, Cache Memory, Primary
Memory, Secondary Storage Devices, Hard Disks, Optical Drives, USB Flash Drives, Memory Cards.

Unit – II

Computer Software: Introduction, Classification of Computer Software, System Software, Application
Software, Firmware, Middleware, Acquiring Computer Software.
Operating Systems: Introduction, Evolution of OS, Process Management, Memory Management,
FileManagement, Device Management, Security Management, Command Interpreter, Windows, Linux.

Text   Reema Thareja, Fundamentals of Computers

References
                 1. P. K. sinha, Computer Fundamentals
                 2. Anita Goel, Computer Fundamentals
                 3. V. Rajaraman, Fundamentals of Computers
                 4. E. Balagurusamy, Fundamentals of Computers
                 5. J. Glenn Brookshear, Dennis Brylow, Computer Science An Overview

Note:
Student friendly video lecturers pertaining to this course are
available at http://spoken-tutorial.org/

SEC–3 [A]   Discrete Structures -1   BS502

Theory   2 Hours/Week   2 credits

Unit – I

Mathematical logic : Introduction, Statements and Notation, Connectives, Normal Forms, Theory of Inference for the Statement Calculus, The Predicate Calculus, Inference Theory of the Predicate Calculus.

Unit – II

Set theory **:** Introduction, Basic Concepts of Set Theory, Representation of Discrete Structures, Relations and Ordering, Functions.
*Algebraic Structure s***:** Introduction, Algebraic Systems, Semi groups and Monoids, Groups, Lattices as Partially Ordered Sets, Boolean algebra.

TEXT BOOKS:

1. Discrete Mathematical Structures with Applications to Computer Science, J.P.Tremblay, R. Manohar, McGraw Hill education (India) Private Limited.

REFERENCE BOOKS:

1. Discrete Mathematics and its Applications, Kenneth H. Rosen, 7th Edition, McGrawHill education (India) Private Limited.
2. Discrete Mathematics, D.S. Malik & M.K. Sen, Revised edition Cengage Learning.
3. Elements of Discrete Mathematics, C. L. Liu and D. P. Mohapatra, 4th edition,McGraw Hill education (India) Private Limited.
4. Discrete Mathematics with Applications, Thomas Koshy, Elsevier.
5. Discrete and Combinatorial Mathematics, R. P. Grimaldi, Pearson.

SEC–3 [B]   Computer Organization   BS502

Theory   2 Hours/Week   2 credits

Unit – I

Latches and Flip-Flops: Introduction, Set-Reset Latch, Gated Latches, Edge-Triggered D Flip-Flop, S-R Flip-Flop, J-K Flip-Flop, T Flip-Flop, Flip-Flops with Additional Inputs, Asynchronous Sequential Circuits. *Registers and Counters*: Registers and Register Transfers, Shift Registers, Design of Binary Counters, Counter Design Using D Flip-Flops, Counter Design Using S-R and J-K Flip-Flops, Derivation of Flip-Flop Input Equations.

Unit – II

Sequential Circuit Design: Design Example—Code Converter, Design of Iterative Circuits, Design of Sequential Circuits Using ROMs and PLAs, Simulation and Testing of Sequential Circuits, Computer-Aided Design. *Circuits for Arithmetic Operations*: Serial Adder with Accumulator, Design of a Binary Multiplier, Design of a Binary Divider.

Text Charles   H. Roth, Jr. and Larry L. Kinney, Fundamentals of Logic Design (7e)

References

1.M. Morris Mano, Michael D. Ciletti, Digital Design (4e)
2.A. Saha and N. Manna, Digital Principles and Logic Design
3.M. Rafiquzzaman, Fundamentals of Digital Logic and Microcontrollers (6e)
4.Elliott Mendelson, Theory and Problems of Boolean Algebra and Switching Circuit
5.M. Morris Mano, Charles R. Kime, Tom Martin, Logic and Computer Design Fundamentals

DSC–3E   Programming in Java   BS505

Theory	3 Hours/Week	3 credits
Practical	2 Hours/Week	1 credit

Unit – I

Introduction: Java Essentials, JVM, Java Features, Creation and Execution of Programs, Data Types, Type Conversion, Casting, Conditional Statements, Loops, Branching Mechanism, Classes, Objects, Class Declaration, Creating Objects, Method Declaration and Invocation, Method Overloading, Constructors–Parameterized Constructors, Constructor Overloading, Cleaning-up unused Objects, Class Variables &Methods-static Keyword, this Keyword, One-Dimensional Arrays, Two-Dimensional Arrays, Command-Line Arguments, Inner Class.
Inheritance: Introduction, Types of Inheritance, extends Keyword, Examples, Method Overriding, super, final Keywords, Abstract classes, Interfaces, Abstract Classes Verses Interfaces.

Unit – II

Packages:Creating and Using Packages, Access Protection, Wrapper Classes, String Class, StringBuffer Class.
Exception: Introduction, Types, Exception Handling Techniques, User-Defined Exception.
Multithreading: Introduction, Main Thread, Creation of New Threads – By Inheriting the Thread Class or Implementing the Runnable Interface, Thread Lifecycle, Thread Priority, Synchronization.
Input/Output: Introduction, java.io Package, File Class, FileInputStream Class, FileOutputStream Class, Scanner Class, BufferedInputStream Class, BufferedOutputStream Class, RandomAccessFile Class.

Unit – III

Applets: Introduction, Example, Life Cycle, Applet Class, Common Methods Used in Displaying the Output.
Event Handling: Introduction, Types of Events, Example. AWT: Introduction, Components, Containers, Button,Label, Checkbox, Radio Buttons, Container Class, Layouts. Swing: Introduction, Differences between Swing and AWT, Jframe, Japplet, Jpanel, Components in Swings, Layout Managers, Jtable, Dialog Box.
Database Handling Using JDBC: Introduction, Types of JDBC Drivers, Load the Driver, Establish Connection, Create Statement, Execute Query, Iterate Resultset, Scrollable Resultset, Developing a JDBS Application.

Text   Sachin Malhotra, Saurabh Choudhary, Programming in Java (2e)

References

1. Bruce Eckel, Thinking in Java (4e)
2. Herbert Schildt, Java: The Complete Reference (9e)
3. Y. Daniel Liang, Introduction to Java Programming (10e)
4. Paul Deitel, Harvey Deitel, Java: How To Program (10e)
5. Cay S. Horsttnann, Core Java Volume I – Fundamentals (10e)
6. C. Thomas Wu, An introduction to object-oriented programming with Java (5e)
7. Tony Gaddis, Starting Out with Java From Control Structures Through Objects (6e)
8. Jeanne Boyarsky, Scott Selikoff, OCA: Oracle Certified Associate Java SE 8 Programmer–I Study Guide.

Java Lab   BS505

Practical   2 Hours/Week   1 credit

1. Write java programs to find the following
   a) largest of given three numbers b) reverses the digits of a number
   c) given number is prime or not d) GCD of given two integers
2. Write java programs that implement the following
   a) default constructor b) parameterized constructor c) constructor overloading
3. a) Write a java program to find the smallest of given list integers using array and scanner class.
   b) Write a java program for multiplication of two matrices.
4. a) Write a java program for demonstrating an inner classes or nested classes.
   b) Write a java program to implement method overloading, method overriding, dynamic method dispatch
5. Write a java program to implement single, multilevel, hierarchal, multiple, hybrid inheritances.
6. Write java programs that demonstrate the use of abstract, this, super, static, final keywords
7. a) Write a java program for creating a package and using a package.
   b) Write a java program to demonstrate the use of wrapper classes.
8. a) Write a java program using all five keywords of exception handling mechanism.
   b) Write a java program for creating customized (user) exception
9. a) Write a java program that checks whether a given string is a palindrome or not.
   b) Write a java program for sorting a given list of names in ascending order.
10. a) Write a java program to create a file, write the data and display the data.
    b) Write a java program that reads a file name from user and displays its information.
11. a) Write a java program for controlling main thread.
    b) Write a java program for creating new thread by extending Thread class.
12. a) Write a java program for creating new thread by implementing Runnable interface.
    b) Write a java program for thread synchronization.
13. a) Write a java program to create following AWT components: Button, Checkbox, Choice, and List.
    b) Write java programs to create AWT application using containers and layouts.
14. a) Write java programs to create a simple Applet and create swing based Applet.
    b) Write a java program to handle different types of events in a swing application.
15. Write java programs to create a swing application using swing components and layouts.
16. Write a java program to store and retrieve data from database using JDBC.

DSE–1E	Operating Systems		BS506
	Theory	3 Hours/Week	3 credits
	Practical	2 Hours/Week	1 credit

Unit – I

Introduction: Computer-System Architecture, Computing Environments. Operating-System Structures: Operating-System Services, User Interface for Operating-System, System Calls,Types of System Calls, Operating System Structure.
Process Management: Process Concept, Process Scheduling, Operations on Processes, Inter process communication, Examples–Producer-Consumer Problem.
Process Synchronization: Critical-Section Problem, Peterson's Solution, Synchronization, Semaphores, Monitors.

Unit – II

CPU Scheduling: Concepts, Scheduling Criteria, Scheduling Algorithms.
Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

Unit – III

Main Memory: Introduction, Swapping, Contiguous Memory Allocation, Segmentation, Paging.
Virtual Memory: Introduction, Demand Paging, Page Replacement, Allocation of Frames, Thrashing.
Mass-Storage Structure: Overview, Disk Scheduling, RAID Structure.
File Systems: File Concept, Access Methods, Directory and Disk Structure, File-System Mounting, Protection. File System Implementation, Directory Implementation, Allocation Methods, Free-Space Management.

Text   Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Concepts (9e)

References

1. Naresh Chauhan, Principles of Operating Systems
2. Thomas W. Doeppner, Operating Systems in Depth
3. Andrew S. Tanenbaum, Modern Operating Systems
4. William Stallings, Operating Systems – Internals and Design Principles
5. Dhananjay M. Dhandhere, Operating Systems – A Concept Based Approach

Operating Systems Lab   BS506

Practical   2 Hours/Week   1 credit

1.a) Use vi editor to create different files, writing data into files, modifying data in files.

   b) Use different types of Unix commands on the files created in first program.

2. Write shell programs using 'case', 'then' and 'if' & 'else' statements.

3.Write shell programs using while, do-while and for loop statements.

4.a) Write a shell script that accepts two integers as its arguments and computers the value of first number raised to the power of the second number.

   b) Write a shell script that takes a command –line argument and reports on whether it is directory, a
        file, or something else.

5.a) Write a shell script that accepts a file name, starting and ending line numbers as arguments and displays all
        the lines between the given line numbers..

   b) Write a shell script that deletes all lines containing a specified word in one or more files supplied as
        arguments to it.

6.a) Write a shell script that displays a list of all the files in the current directory to which the user has read, write and execute permissions.

   b) Develop an interactive script that ask for a word and a file name and then tells how many times that word occurred in the file.

7. Write a program that simulate the following Unix commands like ls, mv, cp.

8. Write a program to convert upper case to lower case letters of a given ASCII file.

9. Write a program to program to search the given pattern in a file.

10. Write a program to demonstrate FCFS process schedules on the given data.

11. Write a program to demonstrate SJF process schedules on the given data.

12 .Write a program to demonstrate Priority Scheduling on the given burst time and arrival times.

13. Write a program to demonstrate Round Robin Scheduling on the given burst time and arrival times.

14. Write a program to implementing Producer and Consumer problem using Semaphores.

15. Write a program to simulate FIFO, LRU, LFU Page replacement algorithms.

16 .Write a program to simulate Sequential, Indexed, and Linked file allocation strategies.

DSE–2E   Software Engineering   BS506

Theory	3 Hours/Week	3 credits
Practical	2 Hours/Week	1 credit

Unit – I

Software Engineering – Introduction, Program Versus Software, Software Engineering, Software Development Process and its Stages, Generic Software Development Process Models, Code of Ethics and Professional Practice, Software Development and Maintenance Cost Breakup.

Requirement Engineering Processes – Requirement Engineering Process, Feasibility Study, Cost and Benefit Analysis, Requirement Specification, Characteristics of a Good Requirement and Validation Techniques, Requirements Management Planning, Process of Requirement Change Management.

Software Requirement Specifications – Introduction, Stakeholder Analysis, Software Requirements Document, IEEE Standard of Software Requirement Specifications, Organizing Functional Requirements,Traceability and Validation of Specifications.

Unit – II

Architectural Styles – Introduction, Architecture Styles, Object Oriented Architecture, Inter-organizational Communication, Cloud Computing Architecture Style, Core, Configurable and Customizable Architecture, Design Models, Architectural Design Principles.

Object Oriented System Analysis – Introduction, Object Oriented Design, Object Oriented Design Models, Object Oriented Analysis, Data Modeling, Comparison Between Top Down Structured and Object Oriented Analysis, Description of Logical and Static Modeling, Identification of Class Relationships.

Object Oriented Design Using UML – Introduction, Sequence Diagram, State Machine Diagram, Timing Diagram, Describing Detailed Object Oriented Design, Decision Tree and Decision Table, Composite Structure Diagram, Generating Test Cases, Moving Towards Physical Design, Structured Methods.

Unit – III

Software Development – Introduction, Good Coding Practices, Code Reuse, Design Pattern, Generator Based Reuse, Application/Software Developed on Product Lines Approach, Component Based Software Engineering, Agile Methods.

Verification, Validation and Software Testing – Introduction, Software Verification and Validation Process, Software Testing, System Testing, Object Oriented Testing Strategy, Test Cases, Equivalence Partitioning (Black Box Testing), Art of Debugging.

Measurement and Metrics for Assessing Software Quality – Introduction, ISO 9126 Quality Standards, Quality Management Models, Ways to Build Quality in Software, Software Quality Control and Metrics, Defect Density Metrics, Chidamber and Kemerer Metric Suites for Object Oriented System, Class Coupling Metric-Coupling Between Objects, Monitoring Dynamic Quality Attributes (Visible Externally) of a Software.

Text Rajesh   Narang, Software Engineering: Principles and Practices

References
1. Ian Sommerville, Software Engineering
2. R. Mall, Fundamentals of Software Engineering
3. Pankaj Jalote, An Integrated Approach to Software Engineering
4. Frank Tsui, Orlando Karam, Barbara Bernal, Essentials of Software Engineering
5. Roger S Pressman, B R Maxim, Software Engineering – A Practitioner's Approach
6. Grady Booch, The Unified Modeling Language User Guide

Software Engineering Lab

BS506

<div align="center">Practical 2 Hours/Week 1 credit</div>

Case Studies:

1 Banking System

2 Hotel management system

3 Inventory Control System

4 Library management system

5 Railway Reservation System

Choose any two of above case studies and do the following exercises for those case studies

1 Write the complete problem statement

2 Write the software requirements specification document

3 Draw the entity relationship diagram

4 Draw the data flow diagrams

5 Draw use case diagrams

6 Draw activity diagrams for all use cases

7 Draw sequence diagrams for all use cases

8 Draw collaboration diagram

9 Assign objects in sequence diagrams to classes and make class diagram.

Note:
- To draw dataflow diagrams use preferably Microsoft Visio Software, SmartDraw, etc…
- To draw UML diagrams use preferably Rational Rose Software, StarUML, etc...
- The teacher should define the boundaries for the above case study problems and make the practice Of problems mentioned.

DSE–3E	Data mining		BS506
	Theory	3 Hours/Week	3 credits
	Practical	2 Hours/Week	1 credit

Unit I

Data Mining and Knowledge Discovery Process: data mining, Data Mining Differ from Other Approaches - The Knowledge Discovery Process-Introduction, Knowledge Discovery Process, Knowledge Discovery Process Models. *Data Understanding*: Data, Concepts of Learning, Classification, and Regression

Unit II

Data Mining: Methods for Constructing Data Models: Unsupervised Learning: Clustering-From Data to information Granules or Clusters, Categories of Clustering Algorithms, Hierarchical Clustering, Objective Function-Based Clustering, Cluster Validity, random Sampling and Clustering as a Mechanism of Dealing with large datasets. *Association Rules* : Introduction, Association Rules and transactional Data , Mining Single Dimensional , Single-Level Boolean Association Rules, Mining Other Types of Association Rules.

Unit III

Supervised Learning: Bayesian Methods, Regression- Decision Trees, Rule and Hybrids Algorithms.
Text Mining: Introduction, Information Retrieval Systems, Improving Information Retrieval Systems.
Data Security, Privacy and Data Mining: Privacy in Data Mining, Privacy Versus Levels of Information Granularity, Distributed Data Mining, Collaborative Clustering.

Text Books:

1. Data mining A knowledge discovery approach , Pedrycz, Kurgan, Springer ,

2007 References:

1. Data mining Concepts and Techniques , Micheline Kamber, third edition, MK Elsevier publications

2. Principles of data mining , David hand Heikki Mannila , PHI publications-2004

Data mining Lab   BS506
Practical   2 Hours/Week   1 credit

Example programs:

1. Demonstration of preprocessing on dataset student.arff

2. Demonstration of preprocessing on dataset labor.arff

3. Demonstration of Association rule process on dataset contactlenses.arff using apriori algorithm

4. Demonstration of Association rule process on dataset test.arff using apriori algorithm

5. Demonstration of classification rule process on dataset student.arff using j48 algorithm

6. Demonstration of classification rule process on dataset employee.arff using j48 algorithm

7. Demonstration of classification rule process on dataset employee.arff using id3 algorithm

8. Demonstration of classification rule process on dataset employee.arff using naïve bayes algorithm

9. Demonstration of clustering rule process on dataset iris.arff using simple k-means

10. Demonstration of clustering rule process on dataset student.arff using simple kmeans

NOTE:
- All the concepts of programs from Text Book including exercises must be practiced, executed and written down in the practical record book.

- Faculty must take care about UG standard programs it should be minimum 25 – 30.

- In the external lab examination student has to execute at least three programs with compilation and deployment steps are necessary.

- External Viva-voce is compulsory.

| GE–2 | Information Technologies – 2 | BS601 |

GE–2　　　　　　　　　Information Technologies – 2　　　　　　　　BS601

Theory2 Hours/Week　　　　　2 credits

Unit – I

Introduction to Algorithms and Programming Languages: Algorithm, Control Structures, Flowcharts, Pseudo code, Programming Languages, Generations of Programming Languages.
Database Systems: File Oriented Approach, Database Oriented Approach, Database Views, Three-Schema Architecture, Database Models, Components of DBMS, Introduction of SQL Queries.

Unit – II

Computer Networks: Introduction, Connection Media, Data Transmission Mode, Data Multiplexing, Data Switching, Network Topologies, Types of Networks, Networking Devices, OSI Model. *The Internet*: Internet Services, Types of Internet Connections, Internet Security.
Emerging Computer Technologies: Distributed Networking, Peer-to-peer Computing, Grid Computing, Cloud Computing, Utility Computing, On0demand Computing, Wireless Network, Bluetooth, Artificial Intelligence.

Text　　　　　　　　　　Reema Thareja, Fundamentals of Computers

References

　　　　　　　　　　1. P. K. sinha, Computer Fundamentals
　　　　　　　　　　2. Anita Goel, Computer Fundamentals
　　　　　　　　　　3. V. Rajaraman, Fundamentals of Computers
　　　　　　　　　　4. E. Balagurusamy, Fundamentals of Computers
　　　　　　　　　　5. J. Glenn Brookshear, Dennis Brylow, Computer Science An Overview

Note:
Student friendly video lecturers pertaining to this course are available at http://spoken-tutorial.org/

SEC–4 [A]   Discrete Structures -2   BS602

Theory   2 Hours/Week   2 credits

Unit – I

Elementary Combinatorics **:** Basics of Counting, Combinations and Permutations, Enumeration of Combinations and Permutations, Enumerating Combinations and Permutations with Repetitions, Enumerating Permutations with Constrained Repetitions, Binomial Coefficients, The Binomial and Multinomial Theorems, The Principle of Inclusion-Exclusion.

Unit – II

Recurrence Relations **:** Generating Functions of Sequences, Calculating Coefficients of generating functions, Recurrence relations, Solving recurrence relations by substitution and Generating functions, The method of Characteristic roots, Solutions of Inhomogeneous Recurrence Relations.

*Graph s***:** Basic Concepts, Isomorphisms and Subgraphs, Trees and their Properties, Spanning Trees, Directed Trees, Binary Trees, Planar Graphs, Euler's Formula, Multigraphs and Euler Circuits, Hamiltonian Graphs, Chromatic Numbers, The Four-Color Problem.

TEXT BOOKS:

1. Discrete Mathematics for Computer Scientists & Mathematicians, Joe L. Mott, Abraham Kandel, Theodore P. Baker, Pearson , 2nd ed.

REFERENCE BOOKS:

1. Discrete Mathematics and its Applications, Kenneth H. Rosen, 7th Edition, McGrawHill education (India) Private Limited.
2. Discrete Mathematics, D.S. Malik & M.K. Sen, Revised edition Cengage Learning.
3. Elements of Discrete Mathematics, C. L. Liu and D. P. Mohapatra, 4th edition,McGraw Hill education (India) Private Limited.
4. Discrete Mathematics with Applications, Thomas Koshy, Elsevier.
5. Discrete and Combinatorial Mathematics, R. P. Grimaldi, Pearson.

SEC–4[B]   Information Security   BS602

Theory   2 Hours/Week   2 credits

Unit – I

Introduction to Information Security – Need for Information Security, Threats to Information
Systems, Information Assurance, Cyber Security.
Introduction to Application Security and Counter Measures – Introduction to Application Security, Data
Security Considerations, Security Technologies, Security Threats, Security Threats to E-Commerce, E-Cash
and Electronic Payment System.

Unit – II

Credit/Debit/Smart Cards, Digital Signature, Cryptography and Encryption, Information
Security Governance and Risk Management.
Introduction to Security Policies and Cyber Laws – Need for an Information Security Policy,
Introduction to Indian Cyber Law, Objective and Scope of the IT Act, 2000, Intellectual Property Issues,
Overview of *Intellectual-Property-* Related Legislation in India, Patent, Copyright.

Text   Dr. Surya Prakash T, Ritendra G, Praveen Kumar S, KLSI, Introduction to information
                        security and cyber laws (Dreamtech Publication)

References

1. Anderson, Ross, Security Engineering
2. G.R.F. Snyder, T. Pardoe, Network Security
3. Mark Stamp, Information Security: Principles and Practice
4. A.Basta, W.Halton, Computer Security: Concepts, Issues and Implementation
5. Mark S. Merkow, Jim Breithaupt, Information Security: Principles and Practice

DSC–3F	Web Programming	BS605

Theory	3 Hours/Week	3 credits
Practical	2 Hours/Week	1 credit

Unit – I

Structuring Documents for the Web: Introducing HTML and XHTML, Basic Text Formatting, Presentational Elements, Phrase Elements, Lists, Editing Text, Core Elements and Attributes, Attribute Groups *Links and Navigation*: Basic Links, Creating Links with the <a> Element, Advanced E- mail Links. *Images, Audio, and Video*: Adding Images Using the <img> Element, Using Images as Links Image Maps, Choosing the Right Image Format, Adding Flash, Video and Audio to your web pages. *Tables*: Introducing Tables, Grouping Section of a Table, Nested Tables, Accessing Tables
Forms: Introducing Forms, Form Controls, Sending Form Data to the Server
Frames: Introducing Frameset, <frame> Element, Creating Links Between Frames, Setting a Default Target Frame Using <base> Element, Nested Framesets, Inline or Floating Frames with <iframe>.

Unit – II

Cascading Style Sheets: Introducing CSS, Where you can Add CSS Rules.
CSS Properties: Controlling Text, Text Formatting, Text Pseudo Classes, Selectors, Lengths, Introducing the Box Model.
More Cascading Style Sheets: Links, Lists, Tables, Outlines, The :focus and :activate Pseudo classes Generated Content, Miscellaneous Properties, Additional Rules, Positioning and Layout with CSS *Page Layout*: Understating the Site's Audience, Page Size, Designing Pages, Coding your Design, Developing for Mobile Devices.
Design Issues: Typography, Navigation, Tables, Forms.

Unit – III

Learning JavaScript: How to Add Script to Your Pages, the Document Object Model, Variables, Operators, Functions, Control Statements, Looping, Events, Built- In Objects.
Working with JavaScript: Practical Tips for Writing Scripts, Form Validation, Form Enhancements, JavaScript Libraries.
Putting Your site on the web: Meta tags, Testing your site, Talking the Leap to Live, Telling the World about your site, Understanding your visitors.

Text   Jon Duckett, Beginning HTML, XTML, CSS and JavaScript

References

1. Chris Bates, Web Programming
2. M. Srinivasan, Web Technology: Theory and Practice
3. Achyut S. Godbole, Atul Kahate, Web Technologies
4. Kogent Learning Solutions Inc, Web Technologies Black Book
5. Ralph Moseley and M. T. Savaliya, Developing Web Applications
6. P.J. Deitel & H.M. Deitel, Internet and World Wide Web How to program

Practical   2 Hours/Week   1 credit

1 a. Write a HTML program using basic text formatting tags, <hn>, <p>, <br>, <pre>.

   b. Write a HTML page for Example Cafe using above text formatting tags.

2 a. Write a HTML program using presentational element tags <b>, <i>, <strike>,

 <sup>, <sub>, <big>, <small>, <hr>

   b. Write a HTML program using phrase element tags <blockquote>, <cite>,

 <abbr>, <acronym>, <kbd>, <address>

3 a. Write a HTML program using different list types.

   b. Write a HTML page that displays ingredients and instructions to prepare a recipe.

4 a. Write a HTML program using grouping elements <div> and <span>.

   b. Write a HTML Menu page for Example cafe site.

5 a. Write a HTML program using images, audios, videos.

   b. Write a HTML program to create your time table.

6 Write a HTML program to create a form using text inputs, password inputs, multiple line

   text input, buttons, check boxes, radio buttons, select boxes, file select boxes.

7 Write a HTML program to create a frames and links between frames.

8 Write a HTML program to create different types of style sheets.

9 Write a HTML program to create CSS on links, lists, tables and generated content.

10 Write a HTML program to create your college web site using multi column layouts.

11 Write a HTML program to create your college web site using for mobile device.

12 Write a HTML program to create login form and verify username and password using DOM

13 a. Write a JavaScript program to calculate area of rectangle using function.

   b. Write a JavaScript program to wish good morning, good afternoon, good evening

   depending on the current time.

14 a. Write a JavaScript program using switch case?.

   b. Write a JavaScript program to print multiplication table of given number using loop.

15 a. Write a JavaScript programs using any 5 events.

   b. Write a JavaScript program using JavaScript built in objects.

16 Write a JavaScript program to create registration form and validate all fields using form validation

NOTE:
- All the concepts of programs from Text Book including exercises must be practiced, executed and written down in the practical record book.

- Faculty must take care about UG standard programs it should be minimum 25 – 30.

- In the external lab examination student has to execute at least three programs with compilation and deployment steps are necessary.

- External Viva-voce is compulsory.

DSE-1B   **PHP with MySQL**   **BS606**

Theory   3 Hours/Week   3 credits
Practical   2 Hours/Week   1 credit

Unit – I

Introducing PHP – What is PHP? Why use PHP? Evolution of PHP, Installing PHP, Other ways to run
PHP, Creating your first script. PHP Language Basics – Using variables, Understanding Data Types,
Operators and Expressions, Constants. Decisions and Loops – Making Decisions, Doing Repetitive Tasks
with Looping, Mixing Decisions and Looping with HTML.
Strings – Creating and Accessing Strings, Searching Strings, Replacing Text with Strings, Dealing with Upper
and Lowercase, Formatting Strings. Arrays – Creating Arrays, Accessing Array Elements, Looping Through
Arrays with for-each, Working with Multidimensional Arrays, Manipulating Arrays.

Unit – II

Functions – What is a Function? Why Functions are useful? Calling Functions, Working with Variable
Functions, Writing your own Functions, Working with References, Writing Recursive Functions.
Objects – Introduction OOP Concepts, Creating Classes and Objects in PHP, Creating and using Properties,
Working with Methods, Object Overloading with _get(), _set() and _call(), Using Inheritance to Extend
Power of Objects, Constructors and Destructors, Automatically Loading Class Files, Storing as Strings.
Handling HTML Forms with PHP – How HTML form works, Capturing Form Data with PHP, Dealing with
Multi-Value Fields, Generating Web Forms with PHP, Storing PHP Variables in Forms, Creating File
Upload Forms, Redirecting After a Form Submission.

Unit – III

Working with Files and Directories - Getting Information on Files, Opening and Closing Files, Reading
and Writing to Files, Copying, Renaming, and Deleting Files, Working with Directories.
Introducing Databases and SQL – Deciding How to Store Data, Understanding Relational Databases,
Setting Up MySQL, A Quick Play with MySQL, Connecting MySQL from PHP.
Retrieving Data from MySQL with PHP – Setting Up the Book Club Database, Retrieving Data with SELECT,
Creating a Member Record Viewer. Manipulating MySQL Data with PHP – Inserting, Updating, and Deleting
Records, Building a Member Registration Application.

Text   Matt Doyle, Beginning PHP 5.3 (Wrox – Wiley Publishing)
References

    1. Ellie Quigley, PHP and MySQL by Example
    2. Joel Murach, Ray Harris, Murach's PHP and MySQL
    3. Brett McLaughlin, PHP & MySQL: The Missing Manual
    4. Luke Welling, Laura Thomson, PHP and MySQL Web Development
    5. W. Jason Gilmore, Beginning PHP and MySQL From Novice to Professional
    6. Andrew Curioso, Ronald Bradford, Patrick Galbraith, Expert PHP and MySQL

PHP with MySQL Lab   BS606

Practical   2 Hours/Week   1 credit

1 a) Write a PHP script to find the factorial of a given number.
b) Write a PHP script to find the sum of digits of a given number.

2 a) Write a PHP script to find whether the given number is a prime or not.
b) Write a PHP script to demonstrate the use of break, continue statements using nested loops.

3 a) Write a PHP script to display the Fibonacci sequence with HTML page.
b) Write a PHP script to create a chess board.

4a) Write a PHP script using built-in string function like strstr(), strops(), substr_count(), etc...
b) Write a PHP script to transform a string to uppercase, lowercase letters, make a string's
first character uppercase.

5 a) Write a PHP script that inserts a new item in an array in any position.
b) Write a PHP function to check whether all array values are strings or not.

6 a) Write a PHP script to count number of elements in an array and display a range of array elements.
b) Write a PHP script to sort a multi-dimensional array set by a specific key.

7 a) Write a PHP script using a function to display the entered string in reverse.
b) Write a PHP script using function for sorting words in a block of text by length.

8a) Write a PHP script for creating the Fibonacci sequence with recursive function.
b) Write a PHP script using pass by value and pass by reference mechanisms in passing
arguments to functions.

9 a) Write a PHP script to demonstrate the defining and using object properties.
b) Write a PHP script to demonstrate the inheritance.

10 a) Write a PHP script to demonstrate the object overloading with _get(), _set(), and _call().
b) Write a PHP script to demonstrate the overloading property accesses with _get() and _set().

11 a) Write a PHP script to demonstrate the method overloading and method overriding
mechanisms. b) Write a PHP script to demonstrate the use of final classes and final methods.

12 a) Write a PHP script to demonstrate the use interfaces.
b) Write a PHP script using constructors and destructors.

13 Write a PHP application to handling HTML forms with PHP script.

14 a) Write a PHP script to create a file, write data into file and display the file's data.
b) Write a PHP script to check and change file permissions, copying, renaming and deleting files.

15 a) Write a PHP application for connecting to MySQL and reading data from database table.
b) Write a PHP application for inserting, updating, deleting records in the database table.

16 Write a PHP application for student registration form.

DSE-2B   Computer Graphics   BS606

Theory   3 Hours/Week   3 credits
Practical   2 Hours/Week   1 credit

Unit I

Computer Graphics: Graphs and Charts, Computer-Aided Design, Virtual-Reality Environments, Data Visualizations, Education and Training, Computer Art, Entertainment, Image Processing, Graphical User Interfaces. Computer Graphics Hardware: Video Display Devices, Raster-Scan System, GraphicsWorkstations and Viewing Systems, Input Devices, Hard-Copy Devices, Graphics Networks, Graphics on the Internet. Computer Graphics Software: Coordinate Representations, Graphics Functions, Software Standards, Other Graphics Packages, Introduction to OpenGL.

Unit II

Graphics Output Primitives: Coordinate Reference Frames, Specifying A Two-Dimensional World-Coordinate Reference Frame in OpenGL, OpenGL Point Functions, OpenGL Line Functions, OpenGL Curve Functions, Fill-Area Primitives, Polygon Fill Areas, OpenGL Polygon Fill-Area Functions, OpenGL Vertex Arrays, Pixel-Array Primitives, OpenGL Pixel-Array Functions, Character Primitives, OpenGL Character Functions, Picture Partitioning, OpenGL Display Lists, OpenGL Display-Window Reshape Function. Attributes of Graphics Primitives: OpenGL State Variables, Color and Grayscale, OpenGL Color Functions, Point Attributes, OpenGL Point-Attribute Functions, Line Attributes, OpenGL Line-Attribute Functions, Curve Attributes, Fill-Area Attributes, OpenGL Fill-Area Attribute Functions, Character Attributes, OpenGL Character-Attribute Functions, openGL Antialiasing Functions, OpenGL Query Functions, OpenGL Attribute Groups. Algorithms for Graphics Primitives and Attributes: Line-Drawing Algorithms, Circle-Generating Algorithms, Ellipse-Generating Algorithms.

Unit III

Two-Dimensional Geometric Transformations: Basic Two-Dimensional Geometric Transformations, Matrix Representations, Inverse Transformations, Two-Dimensional Composite Transformations, Raster Methods for Geometric Transformations, OpenGL Raster Transformations, Transformations between Two-Dimensional Coordinate Systems, OpenGL Functions for Two-Dimensional Geometric Transformations. Two-Dimensional Viewing: The Two-Dimensional Viewing Pipeline, The ClippingWindow, Normalization and Viewport Transformations, OpenGL Two-Dimensional Viewing Functions, Clipping Algorithms, Two-Dimensional Point Clipping, Two-Dimensional Line Clipping, Polygon Fill-Area Clipping, Curve Clipping, Text Clipping.

Text Book:
1. Donald D. Hearn, M. Pauline Baker, Warren Carithers "Computer Graphics with Open GL" 4th Edition,

2011. References:

1. J.D. Foley, A van Dam, S.K. Feiner and J.F. Hughes, *Computer Graphics: Principals and Practices,* 2nd Ed., Addison-Wesley, MA, 1990.

2. D.F. Rogers, *Procedural Elements in Computer Graphics,* 2nd Ed., McGraw Hill Book Company, 2001.

3. D.F. Rogers and A.J. Admas, *Mathematical Elements in Computer Graphics*, 2nd Ed., McGraw Hill Book Company, 1990.

Computer graphics Lab   BS606

Practical   2 Hours/Week   1 credit

NOTE:

All the concepts of programs from Text Book including exercises must be practiced, executed and written down in the practical record book.

Faculty must take care about UG standard programs , it should be minimum 25 – 30.

In the external lab examination student has to execute at least three programs with compilation and deployment steps are necessary.

External Viva-voce is compulsory.

Example programs:

1. Program to recursively subdivide a tetrahedron to from 3D Sierpinski gasket. The number of recursive steps is to be specified by the user.

2. Program to implement Liang-Barsky line clipping algorithm.

3. Program to draw a color cube and spin it using OpenGL transformation matrices.

4. Program to create a house like figure and rotate it about a given fixed point using OpenGL functions.

5. Program to implement the Cohen-Sutherland line-clipping algorithm. Make provision to specify the input line, window for clipping and view port for displaying the clipped image.

6. Program to create a cylinder and a parallel piped by extruding a circle and quadrilateral respectively. Allow the user to specify the circle and quadrilateral.

7. Program using OpenGL functions, to draw a simple shaded scene consisting of a tea pot on a table. Define suitably the position and properties of the light source along with the properties of the surfaces of the solid object used in the scene.

8. Program to draw a color cube and allow the user to move the camera suitably to experiment with perspective viewing. Use OpenGL functions.

9. Program to fill any given polygon using scan-line area filling algorithm. (Use appropriate data structures.)

10. Program to display a set of values {fij} as a rectangular mesh.

DSE-3B   Computer Networks   BS606

Theory	3 Hours/Week	3 credits
Practical	2 Hours/Week	1 credit

Unit I

Introduction: data communication- components, Networks, Protocols and Standards, Line configuration, topology, transmission mode, categories of networks.
OSI and TCP/IP Models: Layers and their functions, comparison of models.
Multiplexing: Many To One/One To Many, Frequency-Division Multiplexing (FDM), Wave-Division Multiplexing (WDM), Time-Division Multiplexing (TDM).

Unit II

Error Detection and Correction: Types of Errors, Detection, Vertical Redundancy Check (VRC), Longitudinal Redundancy Check (LRC), Cyclic Redundancy Check (CRC), Checksum, Error Correction.
Data Link Control: Line Discipline, Flow Control, Error Control, Asynchronous Protocols, Synchronous Protocols, Character-Oriented Protocols, Bit-Oriented Protocols, Link Access Procedures Switching: Circuit Switching, Packet Switching, Message Switching.

Unit III

Transport Layer: Duties of the Transport Layer, Connection, the OSI Transport Protocol.
Upper OSI Layers: Session Layer, Presentation Layer, Application Layer.
TCP/IP Protocol Suite: Overview of TCP/IP, Network Layer, Addressing, Subnetting, Other Protocols In The Network Layer, Transport Layer

Text Book:

1. Behrouz A. Forouzan, *Data Communication and Networking*, 2nd Ed., Tata McGraw Hill.

Books Recommended
1. A.S. Tenanbaum, *Computer Networks*, 4th Ed., Pearson Education Asia, 2003.

2. D. E. Comer, *Internetworking with TCP/IP*, Pearson Education Asia, 2001.

3. William Stallings, *Data and Computer Communications*, 7th Ed., Pearson education Asia, 2002.

Computer Networks Lab

Practical   2 Hours/Week   1 credit

1 Write a program to create a socket and implement connect function.

2 Write a program to get MAC address.

3 Write a program to display hello world using signals.

4 Write a program for socket pair system call using IPC.

5 Write a program to implement the sliding window protocol.

6 Write a program to identify the category of IP address for a given IP address.

7 Write a program to print details of DNS host.

8 Write a program to implement listener and talker.

9 Write a program to implement TCP echo using client–server program.

10 Write a program to implement UDP echo using client–server program.

11 Write a UDP client–server program to convert lowercase letters to uppercase letters.

12 Write a TCP client–server program to convert a given string into reverse.

13 Write a UDP client–server program to convert a given string into reverse.

14 Write a program to implement TCP iterative client–server program.

15 Write a program to implement time service using TCP client–server program.

16 Write a program to implement time service using UDP client–server program.

Note:
Write above program using C language on Unix/Linux systems.

UG (B.Sc.) Scheme of Examinations
Computer Science
(CBCS 2016-17)

Paper	Credits	Theory Exam		Practical Exam
		University Exam	**Internal Exam**	
DSC	4	80 Marks	20 Marks	50 Marks
DSE	3	60 Marks	15 Marks	25 Marks
SEC	2	40 Marks	10 Marks	No Practical Exam
GE	2	40 Marks	10 Marks	

DSC   – Discipline specific core course

DSE   – Discipline specific elective course

SEC   – Skill enhancement course

GE   – Generic elective

4 Credit Core (DSC) Paper

University Exam (Theory)

Time: 3 Hrs.   Maximum marks: 80

Section – A (5 X 4M = 20 Marks)

Answer any five of the following eight questions. Each carries four marks.

Q1. From Unit 1
Q2. From Unit 1
Q3. From Unit 2
Q4. From Unit 2
Q5. From Unit 3
Q6. From Unit 3
Q7. From Unit 4
Q8. From Unit 4

Section – B (4 X 15M = 60 Marks)

Answer all the following four questions. Each carries FIFTEEN marks.

Q09. (a) or (b) from Unit 1
Q10. (a) or (b) from Unit 2
Q11. (a) or (b) from Unit 3
Q12. (a) or (b) from Unit 4

Internal Exam (Theory)

Time: 1 Hr.   Maximum marks: 20

- Two internal exams (one at the middle of the semester and the other at the end) of one-hour duration are to be conducted carrying 15 marks each.
- Average of the scores of two exams should be taken into account.
- Following is the examination pattern.
  - 10 MCQs (multiple choice questions) of half mark each,
  - 10 FIBs (Fill in the Blanks) of half mark each
  - 5 SAQs (short answered questions) of one mark each
  - Totalling 15 marks.
  - 5 marks meant for assignment.

University Exam (Practical)

Time: 2 Hrs.   Maximum marks: 50

- The question paper is to be typeset with five programs with due weightage to all the units from the question bank provided in the syllabus.
- The candidates are to answer any three of them in the practical exam.
- Each question has to carry 10 marks totalling 30 marks.
- Viva – 10 marks
- Record – 10 marks

3 Credit Core (DSE) Paper

University Exam (Theory)

Time: 3 Hrs.   Maximum marks: 60

Section – A (3 X 5M = 15 Marks)

Answer any **THREE** of the following questions. Each carries five marks.

Q1. From Unit 1
Q2. From Unit 1
Q3. From Unit 2
Q4. From Unit 2
Q5. From Unit 3
Q6. From Unit 3

Section – B (3 X 15M = 45 Marks)

Answer all the following three questions. Each carries fifteen marks.

Q7. (a) or (b) from Unit 1
Q8. (a) or (b) from Unit 2
Q9. (a) or (b) from Unit 3

Internal Exam (Theory)

Time: 1 Hr.   Maximum marks:15

- Two internal exams (one at the middle of the semester and the other at the end) of one-hour duration are to be conducted carrying 15 marks each.
- Average of the scores of two exams should be taken into account.
- Following is the examination pattern.

  • 10 MCQs (multiple choice questions) of half mark each,
  • 10 FIBs (Fill in the Blanks) of half mark each
  • 5 SAQs (short answered questions) of one mark each
  • Totalling 15 marks.
  • **No assignment is required.**

University Exam (Practical)

Time: 2 Hrs.   Maximum marks: 25

- The question paper is to be typeset with four programs with due weightage to all the units from the question bank provided in the syllabus.
- The candidates are to answer any two of them in the practical exam.
- Each question has to carry six marks totalling 12 marks.
- Viva – 8 marks
- Record – 5 marks

2 Credit Core (SEC & GE) Papers
University Exam (Theory)

Time: 2 Hrs.   Maximum marks: 40

Section – A (2 X 5M = 10 Marks)

Answer any two of the following four questions. Each carries five marks.
Q1. From Unit 1
Q2. From Unit 1
Q3. From Unit 2
Q4. From Unit 2

Section – B (2 X 15M = 30 Marks)
Answer all the following two questions. Each carries fifteen marks.

Q5. (a) or (b) from Unit 1
Q6. (a) or (b) from Unit 2

Internal Exam (Theory)
Time: 1/2 Hr.   Maximum marks: 10
- One internal exam at the end of the semester, of half an hour duration is to be conducted carrying 10 marks.
- Following is the examination pattern.
  - 10 MCQs (multiple choice questions) of one mark each,
  - No assignment is required.

MOOCs [Massive Online Open Courses] Free Resources

E-Learning:

- NPTEL :nptel.ac.in [Core Subjects Certification]
- C++ INSTITUTE :cppinstitute.org [C++ Certification]
- ORACLEEDUCATION :education.oracle.com [Java, DBMS Certification]
- BIG DATA UNIVERSITY :bigdatauniversity.com [Big Data Certification]
- COURSERA :coursera.org [Core Subjects Certification]
- CODEACADEMY :codecademy.com [Coding Certification]
- KHANACADEMY :khanacademy.org [Core Subjects Certification]
- PIXAR IN A BOX :khanacademy.org/partner-content/pixar
- VIDEOLECTURES :videolectures.net
- YOUTUBEEDU :plus.google.com/+YouTubeEDU/posts
- DISNEY RESEARCH :disneyresearch.com
- ALISON :alison.com [Core Subjects Certification]
- INTERNET ARCHIVE :archive.org

Freeware:
- SCILAB : scilab.org [MatLab Equivalent]
- GEOGEBRA :geogebra.org [Software for Class Room Teaching]

Search Engine:
- WOLFRAM ALPHA :wolframalpha.com [Computing Engine]
- CITESEER :citeseerx.ist.psu.edu [Searching Research Articles]
- DOAJ :doaj.org [Open Access to Journals]