CHAUDHARY BANSI LAL UNIVERSITY, BHIWANI

Scheme and Syllabi of B.Sc. Program with Computer Science under CBCS (Semester I to VI)
(w.e.f. 2021-22)

Paper Code	Paper Name	Type of Course	Credits (Theory/ Practical)	Contact Hours (Theory/ Practical)	Marks (External + Internal)
SEMESTER –I					
20UCS101	Digital Electronics	Core	4	4	40+10=50
20UCS102	Virtual Lab (Based on 20UCS101)	Core	2	4	40+10=50
20USECCS101	Fundamental of IT	SEC (Compulsory)	2	2	40+10=50
20USECCS106	IT Workshop (Based on 20USECCS101)	SEC (Compulsory)	1	2	40+10=50
SEMESTER –Ii					
20UCS201	Problem Solving using Computer	Core	4	4	40+10=50
20UCS202	Software Lab using C	Core	2	4	40+10=50
SEMESTER -III					
20UCS301	Data Structure and Algorithms	Core	4	4	40+10=50
20UCS302	Data Structure and Algorithms Lab	Core	2	4	40+10=50
SEMESTER -IV					
20UCS401	Operating Systems	Core	4	4	40+10=50
20UCS402	Operating Systems Lab	Core	2	4	40+10=50
SEMESTER -V					
Choose One:	**Choose One:**	Discipline Specific Elective	3	3	40+10=50
20UCS501	Database Management Systems				
20UCS502	Discrete Structures				
20UCS503	Internet Technologies				
20UCS504	Artificial Intelligence				
Choose One:	**Choose One:**	Discipline Specific Elective	3	3	40+10=50
20UCS505	Software Engineering				
20UCS506	Computer Networks				
20UCS507	Computer Architecture & Organization				
SEMESTER -VI					
Choose One:	**Choose One:**	Discipline	3	3	40+10=50
20UCS601	Data Mining				

20UCS602	Mobile Computing and Applications	Specific Elective			
20UCS603	E-Commerce Technologies				
20UCS604	Object Oriented Programming using C++				
Choose One:	**Choose One:**	Discipline Specific Elective	3	3	40+10=50
20UCS605	Cloud Computing				
20UCS606	Programming in JAVA				
20UCS607	Management Information Systems				
20UCS608	Project Work/Dissertation				

Skill Enhancement Courses offered by
Department of IC&T
Scheme of Examination of SEC for B.Sc. with Computer Science under CBCS
(w.e.f. 2021-22)

SEMESTER-IV					
Choose One:	Choose One:	Skill Enhancement	3	3	40+10=50
20USECCS401	Office Automation Tools				
20USECCS402	HTML Programming				
20USECCS403	MySQL				
20USECCS404	Multimedia and Applications				
SEMESTER-V					
Choose One:	Choose One:	Skill Enhancement	3	3	40+10=50
20USECCS501	PHP Programming				
20USECCS502	Programming in Visual Basic				
20USECCS503	System Administration and Maintenance				
20USECCS504	Programming in SCILAB				
SEMESTER-VI					
Choose One:	Choose One:	Skill Enhancement	3	3	40+10=50
20USECCS601	Software Testing Concepts				
20USECCS602	Android Programming				
20USECCS603	XML Programming				
20USECCS604	R Programming				

Syllabi of B.Sc. with Computer Science 1st Semester
(w.e.f. 2021-22)

Paper Code	Paper Name	Type of Course	Credits (Theory/ Practical)	Contact Hours (Theory/ Practical)	Marks (External + Internal)
20UCS101	Digital Electronics	Core	4	4	40+10=50
20UCS102	Virtual Lab (Based on 20UCS101)	Core	2	4	40+10=50

20UCS101
Digital Electronics

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

Note: There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.

Objectives:
1. To review basic electronic concepts
2. To review data representation techniques
3. To introduce student to basic concepts of digital logic
4. To introduce the design of basic logical circuits.

Unit-I
Review of Basic Electronics: Diodes – half wave and full wave rectifiers. Zener diode, Zener diode as a voltage regulator, Bipolar Junction Transistors, Transistor configurations- CE characteristics, relation between transistor currents, Transistor biasing methods (CE configuration), small signal CE amplifiers, RC phase shift oscillator, Astable multi-vibrator.

Unit-II
Data Representation: Concept of number system bases – binary, decimal and hexadecimal number systems and conversion between each, Binary arithmetic: Addition, subtraction 1s and 2s complement system, multiplication. Codes: BCD, ASCII, Floating point representation.

Unit-III
Boolean Algebra: Boolean functions: AND, OR and NOT, NAND, NOR and XOR. Truth tables, Combinational logic in Venn diagrams. Realization of other logic gates using NAND and NOR. Laws of Boolean Algebra, DeMorgan's theorems. Min terms, SOP expressions, Max terms, POS expressions, Karnaugh maps. Flip flops – SR flip flop, JK flip flop, Master Slave, D and T flip flops.

Unit-IV
Digital Circuits: Multiplexer, Full and half adders, Subtractors – half and full subtractors, Comparators – 1 bit and 2 bit, Counters, Decoder and display, shift registers, de-multiplexer and keyboard encoder.

Course Outcomes: After completion of course, the student will be able to
1. Gain knowledge between different types of number systems, and their conversions.
2. Design various logic gates and simplify Boolean equations.
3. Design various flip flops, shift registers and determining outputs.
4. Design different types of counters.

Suggested Readings:
a) Text Books:

1. B L Theraja –Basic Electronics-Chand Publications

b) **Reference Books:**

1. M Morris Mano – Digital Logic and Computer Design-Pearson, 2013
2. Thomas L Floyd –Digital Fundamentals- Pearson, 2013

20UCS102
Virtual Lab (Based on 20UCS101)

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

Note: - Every student will maintain practical record of programs done during practical lab in a file. Examination will be conducted through a question paper set jointly by the external and internal examiners. The question paper will consist of questions based on the list of practicals as given under. An examinee will be asked to write the programs and run on computer. Evaluation will be made on the basis of the examinee's performance in written solutions and presentation with viva-voce and practical record.

Practical Examination will be conducted externally as per the following distribution of marks:
Writing solutions of problems and
executing on the Computer: 20 marks.
Presentation &Viva voce: 10 marks.
Practical record: 10 marks.
Internal Assessment: 10 marks (Attendance=5 marks, Assignment=5 marks)

List of Practicals:

1. Study of Computer Hardware and Software
2. Creating Email Id
3. Study of components: Identification of resistors, capacitors and inductors
4. Full wave rectifier – ripple factor for different loads
5. Half wave rectifier - ripple factor for different loads
6. R-C coupled CE amplifier
7. R-C phase shift oscillator
8. Verification of truth table of logic gates
9. SR flip flop
10. JK flip flop
11. Half adder
12. Multiplexer
13. Decoder
14. Zener diode characteristics
15. Astable multi-vibrator
16. Diode characteristics (forward and reverse)
17. Transistor characteristics S

Skill Enhancement Courses
Syllabi of B.Sc. with Computer Science 1ˢᵗ Semester
(w.e.f. 2021-22)

Paper Code	Paper Name	Type of Course	Credits (Theory/ Practical)	Contact Hours (Theory/ Practical)	Marks (External + Internal)
20USECCS101	Fundamental of IT	Skill Enhancement (Compulsory)	2	2	40+10=50
20USECCS106	IT Workshop (Based on 20USECCS101)		1	2	40+10=50

20USECCS101
Fundamental of IT

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

Note: There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.

Objectives:
1. To get the basic concepts of Computers.
2. To get the functional knowledge about PC hardware, operations and concepts.
3. To understand the functional units of a standard PC and it's working.

Unit-I

Computer: Definition, Block Diagram along with its components, characteristics & classification of computers, Limitations of Computers, Human-Being Vs Computer, Applications of computers in various fields. **Information Technology:** Definition, Scope, Applications, IT Tools.
Operating System: Operating System, Types of Operating System, Function of Operating System, Features of Window OS, Types of Software, Proprietary and Open Source Software.

Unit-II

Input devices, Output devices, Printers, Memory: Concept of primary & secondary memory, RAM, ROM, types of ROM, Secondary storage devices.
Overview of Networking: An introduction to computer networking, Types of Network, Network topologies, Modes of data transmission, Transmission media.

Unit-III

Understanding Word Processing: Word Processing Basics; Opening and Closing of documents; Saving a document, Menu Bar, Ribbon, Page setup, Formatting Text, Editing, Printing, drawing table, manipulating table, working with graphics, Mail merge, Inserting equation, Word Art, Smart Art, Header and Footer, Track Changes, Macros.
Working with Presentation: Basics of presentation software; Opening, Saving, creating a Presentation; Preparation and Presentation of Slides; entering and editing text, Insert and delete slides, adding clip art picture.

Unit-IV

Using Spread Sheet: Basics of Spreadsheet; Elements of spreadsheet, Manipulation of cells, saving workbook, entering data, editing data, formatting worksheet, Formula and Function, Working with Charts and Graphics, Data Validation, Conditional Formatting, Sorting, Filtering, Advance Filter, Page Layout.

Course Outcomes: After completion of course, students would be able to understand:

1. Explain principal differences in various operating systems
2. Identify computer systems technical specifications
3. Assemble, disassemble, and configure a computer system.

Suggested Readings:

a) **Text Books:**

1. Gill, Nasib S.: Essentials of Computer and Network Technology, Khanna Book Publishing Co., New Delhi.
2. Gill Nasib Singh: Computing Fundamentals and Programming in C, Khanna Books Publishing Co., New Delhi.

b) **Reference Books:**

1. Chhillar, Rajender S.: Application of IT in Business, Ramesh Publishers, Jaipur.
2. Donald Sanders: Computers Today, McGraw-Hill Publishers.
3. Davis: Introduction to Computers, McGraw-Hill Publishers.

Skill Enhancement Course
Syllabi of B.Sc. with Computer Science 1ˢᵗ Semester
(w.e.f. 2021-22)

20USECCS106
IT Workshop (Based on 20USECCS101)

<div align="right">

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

</div>

Note: - Every student will maintain practical record of programs done during practical lab in a file. Examination will be conducted through a question paper set jointly by the external and internal examiners. The question paper will consist of questions based on the list of practicals as given under. An examinee will be asked to write the programs and run on computer. Evaluation will be made on the basis of the examinee's performance in written solutions and presentation with viva-voce and practical record.

Practical Examination will be conducted externally as per the following distribution of marks:
Writing solutions of problems and
executing on the Computer: 20 marks.
Presentation &Viva voce: 10 marks.
Practical record: 10 marks.
Internal Assessment: 10 marks (Attendance=5 marks, Assignment=5 marks)

List of Practicals:

1. Create a document in MS Word and apply formatting on text.
2. Create a list of 10 best friends. Use Mail Merge feature of MS-WORD to create a Thank You letter for each of your friends from the above two files.
3. Write a macro that is run using the shortcut Ctrl+F for formatting the files.
4. Create a Microsoft word document with the following contents of format?
5. -Insert a table giving number of theory and practical sessions per block.
6. -Demonstrate the Auto Text feature of MS-WORD.
7. Create a document using header footer.
8. Create an Excel Workbook and write all the steps to done with following instructions.
   a) Save this file with name Myexcelfile.
   b) Rename sheet1 with another name: Example.
   c) How to use conditional formatting? Give at least three names of conditional formatting.
9. Create a table of student's data with marks and calculate total marks of all students, percentage of marks of all subjects of any student.
10. Create a power point presentation with name my ppt. Write the steps for following questions:
    a) Insert a movie clip in slide1.
    b) Insert an audio clip in slide2.
    c) Insert a table with five rows and six columns in slide3.
    d) Insert a chart in slide4 .
    e) Insert two shapes in a slide and group those shapes.

Syllabi of B.Sc. with Computer Science 2nd Semester
(w.e.f. 2021-22)

Paper Code	Paper Name	Type of Course	Credits (Theory/ Practical)	Contact Hours (Theory/ Practical)	Marks (External + Internal)
20UCS201	Problem Solving using Computer	Core	4	4	40+10=50
20UCS202	Software Lab using C	Core	2	4	40+10=50

20UCS201
Problem Solving using Computer

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

Note: *There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.*

Objectives:
1. To expose students to algorithmic thinking and algorithmic representations.
2. To introduce students to basic data types and control structures in C.
3. To introduce students to structured programming concepts.
4. To introduce students to standard library functions in C language.

Unit-I

Computer Fundamentals: Introduction to Computers: Characteristics of Computers, uses of computers, Types and generations of Computers, Block Diagram of Computer, Input/output Device.

Planning the Computer Program: Concept of problem solving, Problem definition, Program design, Debugging, Types of errors in programming, Documentation.

Unit-II

Techniques of Problem Solving: Flowcharting, decision table, algorithms, Structured programming concepts, Programming methodologies viz. top-down and bottom-up programming.

Overview of Programming: Programming Logic Using 'C', C Fundamentals: Introduction to C, C-Character set, Data types, Constants, Variables, Identifiers and keywords, Literals, Strings, Operators (Arithmetic operator, Relational operator, Logical or Boolean operator, Assignment, Operator, Ternary operator, Bit wise operator, Increment or Decrement operator).

Unit-III

Input –Output Statement: I/O Functions, % Format Specifiers
Control Statement: Control Loops, Conditional Execution and Nesting of Loops and Conditional Statements.
Function: Defining, Accessing and Passing Arguments to a Function, Function Prototypes, Recursion.

Unit-IV

Arrays and Strings: Single and Multidimensional Arrays, Introduction to Strings, String processing. Pointer, Structure and Union: Understanding Pointers, Pointer and Arrays, Pointer to Function, Defining and processing structures, Pointer and Structures, Concepts of Union.

Course Outcomes: After completion of course, the students will be able to

1. Design an algorithmic solution to a problem using problem decomposition and step-wise refinement.
2. Implement program solution to an algorithm or design specification.
3. Learn the concepts of C Language.

Suggested Readings:

a) **Text Books:**

1. Sinha, P. K., Sinha, Priti, 2007. Computer Fundamentals. BPB Publications, New Delhi.
2. Balaguruswamy, E., 2017. Programming in C. Tata McGraw Hill, New Delhi.
3. Kanetkar, Y.,2016. Let us C. BPB Publication, New Delhi.

b) **Reference Books:**

1. Kernighan, W.B. and Dennis R., 2015. The C Programming Language, Pearson Publications, New Delhi.
2. Goel, A., 2010. Computer Fundamentals. Pearson Education.
3. Forouzan, B., Gilberg A., and Richard, F., 2007. Structured programming approach using C. Cengage learning, 2007

Syllabi of B.Sc. with Computer Science 2nd Semester
(w.e.f. 2021-22)

20UCS202
Software Lab using C

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

Note: - Every student will maintain practical record of programs done during practical lab in a file. Examination will be conducted through a question paper set jointly by the external and internal examiners. The question paper will consist of questions based on problem solving techniques/algorithm using C Language. An examinee will be asked to write the programs and run on computer. Evaluation will be made on the basis of the examinee's performance in written solutions and presentation with viva-voce and practical record.

Practical Examination will be conducted externally as per the following distribution of marks:
Writing solutions of problems and
executing on the Computer: 20 marks.
Presentation &Viva voce: 10 marks.
Practical record: 10 marks.
Internal Assessment: 10 marks (Attendance=5 marks, Assignment=5 marks)

List of Practicals:
1. WAP to find the largest of n natural numbers.
2. WAP to find whether a given number is prime or not.
3. WAP to display a Fibonacci series.
4. WAP to compute Factorial of a number
5. WAP to check whether a given number is odd or even.
6. WAP to print the sum and product of digits of an Integer and reverse the Integer.
7. WAP to check whether a given string is palindrome or not.
8. WAP to check whether a character is VOWEL or CONSONANT with basic operation using switch.
9. Write a program to print all uppercase alphabets using while loop.
10. Write a program to print tables from numbers 2 to 20.
11. Write a program to create an array of 10 integers and find nearest lesser and greater element in an array.
12. Write a program to input N numbers in an array and print out the Armstrong numbers from the set.
13. Write a program to create, initialize, assign and access a pointer variable.
14. Write a program to swap two number using functions.
15. Write a program of simple interest using structure and union.
16. Write a program for the following string operations:
    a. Compare two strings
    b. Concatenate two strings
    c. Compute length of a string

Syllabi of B.Sc. with Computer Science 3rd Semester
(w.e.f. 2021-22)

Paper Code	Paper Name	Type of Course	Credits (Theory/ Practical)	Contact Hours (Theory/ Practical)	Marks (External + Internal)
20UCS301	Data Structure and Algorithms	Core	4	4	40+10=50
20UCS302	Data Structure and Algorithms Lab	Core	2	4	40+10=50

20UCS301
Data Structures and Algorithms

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

Note: *There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.*

Objectives:
1. Be able to analyze the complexity of algorithms
2. Be able to select good algorithms from among multiple solutions for a problem.
3. Have better knowledge on fundamental strategies of algorithm design and awareness on complex algorithm design strategies.
4. Implement some typical algorithms

Unit-I

Introduction to Data Structures, Arrays.
Searching Techniques: Linear and Binary Search.
Sorting Techniques: Elementary sorting Techniques-Bubble Sort, Insertion Sort, Merge Sort, Advanced Sorting Techniques-Heap Sort, Quick Sort, Sorting in Linear Time-Bucket Sort, Radix Sort and Count Sort, Recursion.

Unit-II

Stacks: Implementing stack using array and linked list, Prefix, Infix and Postfix expressions, Utility and conversion of these expressions from one to another; **Queues:** Array and Linked representation of Queue, De-queue, Priority Queues

Unit-III

Linked Lists: Singly, Doubly and Circular Lists, representation of Stack and Queue as Linked Lists.
Trees: Introduction to Tree as a data structure; Binary Trees, Binary Search Tree, (Creation, and Traversals of Binary Search Trees).

Unit-IV

Introduction: Basic Design and Analysis techniques of Algorithms, Correctness of Algorithm
Algorithm Design Techniques: Iterative techniques, Divide and Conquer, Dynamic Programming, Greedy Algorithms.
Complexity Analysis: Medians & Order Statistics.

Course Outcomes: After completion of course, students would be able to:

1. Analyze the algorithms to determine the time and computation complexity and justify the correctness.
2. Implement given Search problem (Linear Search and Binary Search).
3. For a given problem of Stacks, Queues and linked list student will able to implement it and analyze the same to determine the time and computation complexity.
4. Write an algorithm Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort and compare their performance in term of Space and Time complexity.
5. Implement Graph search and traversal algorithms and determine the time and computation complexity.

Suggested Readings: -

a) **Text Book:**
1. Sahni, S., 2011. Data Structures: Algorithms and applications in C++, Second Edition, Universities Press.
2. Tenenbaum, Aaron M., Augenstein M. J., Langsam, Yedidyah, 2009. Data Structures Using C and C++, Second edition, PHI, New Delhi.

b) **Reference Books:**
1. Cormen, T.H., Leiserson, Charles E., Rivest, Ronald L., 2009. Introduction to Algorithms, PHI, New Delhi.
2. Sarabasse & Gelder, A.V.,1999. Computer Algorithm–Introduction to Design and Analysis, Pearson Publications, 3rd Edition.
3. Drozdek, A., 2012. Data Structures and algorithm in C++, Third Edition, Cengage Learning.
4. Kruse, Robert L., 1999. Data Structures and Program Design in C++, Prentice Hall.
5. Malik, D.S., 2010. Data Structure using C++, Second edition, Cengage Learning.

Syllabi of B.Sc. with Computer Science 3rd Semester
(w.e.f. 2021-22)

20UCS302
Data Structure and Algorithms

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

Note: - Every student will maintain practical record of programs done during practical lab in a file. Examination will be conducted through a question paper set jointly by the external and internal examiners. The question paper will consist of questions based on the list of practicals as given under. An examinee will be asked to write the programs and run on computer. Evaluation will be made on the basis of the examinee's performance in written solutions and presentation with viva-voce and practical record.

Practical Examination will be conducted externally as per the following distribution of marks:
Writing solutions of problems and
executing on the Computer: 20 marks.
Presentation & Viva voce: 10 marks.
Practical record: 10 marks.
Internal Assessment: 10 marks (Attendance=5 marks, Assignment=5 marks)

List of Practicals:

1. Implement Insertion Sort (The program should report the number of comparisons)
2. Implement Merge Sort (The program should report the number of comparisons)
3. Implement Heap Sort (The program should report the number of comparisons)
4. Implement Randomized Quick sort (The program should report the number of comparisons)
5. Implement Radix Sort.
6. Implement Searching Techniques
7. Implementation of Recursive function.
8. Array and Linked list implementation of Stack and Queue.
9. Implementation of Single, Double and circular Linked List
10. Creation and traversal of Binary Search Tree.

Syllabi of B.Sc. with Computer Science 4th Semester
(w.e.f. 2021-22)

Paper Code	Paper Name	Type of Course	Credits (Theory/ Practical)	Contact Hours (Theory/ Practical)	Marks (External + Internal)
20UCS401	Operating Systems	Core	4	4	40+10=50
20UCS402	Operating Systems Lab	Core	2	4	40+10=50

20UCS401
Operating Systems

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

Note: There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.

Objectives:
1. Fundamental concepts of systems software and functions of operating systems as a resource manager
2. Strategies for constrained resource allocation and process scheduling
3. Memory and I/O Management techniques
4. Salient features of popular operating systems

Unit-I

Introduction: System Software, Resource Abstraction, OS strategies.

Types of operating systems - Multiprogramming, Batch, Time Sharing, Single user and Multiuser, Process Control & Real Time Systems.

Unit-II

Operating System Organization: Factors in operating system design, basic OS functions, implementation consideration; process modes; methods of requesting system services – system calls and system programs.

Process Management: System view of the process and resources, initiating the OS, process address space, process abstraction, resource abstraction, process hierarchy.

Unit-III

Thread model Scheduling: Scheduling Mechanisms, Strategy selection, non-pre-emptive and pre-emptive strategies. **File System:** Different types of files and their access methods, directory structures, various allocation methods, disk scheduling and management and its associated algorithms.

Memory Management: Mapping address space to memory space, memory allocation strategies, fixed partition, variable partition, paging, virtual memory

Unit-IV

Shell Scripting: Introduction, types of shell, editors in linux, vi editor, modes of operation in vi editor; Shell scripting: writing and executing the shell script, Shell variable (user defined and system variables), System calls, Using system calls, Pipes and Filters, Decision making in Shell Scripts (If else, switch), Loops in shell, Functions, Utility programs (cut, paste, join, tr, uniq utilities), Pattern matching utility (grep).

Course Outcomes: After completion of course, students would be able to:
1. Understanding basic operating system fundamentals
2. Know how an operating system can be used as a service
3. Learn Linux programming concepts
4. Have a foundation stone to understand operating systems working.

Suggested Readings: -

a) **Text Books:**

1. Silberschatz, A., Galvin, P.B., Gagne, G., 2008. Operating Systems Concepts, 8th Edition, John Wiley Publications.

b) **Reference Books:**

1. Tanenbaum, A.S., 2007. Modern Operating Systems, 3rd Edition, Pearson Education.
2. Nutt, G., 1997. Operating Systems: A Modern Perspective, 2nd Edition Pearson Education.
3. Stallings, W., 2008. Operating Systems, Internals & Design Principles, 5th Edition, Prentice Hall of India.
4. Milenkovic, M., 1992. Operating Systems- Concepts and design, Tata McGraw Hill.

Syllabi of B.Sc. with Computer Science 4th Semester
(w.e.f. 2021-22)

20UCS402
Operating Systems Lab

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

Note: - Every student will maintain practical record of programs done during practical lab in a file. Examination will be conducted through a question paper set jointly by the external and internal examiners. The question paper will consist of questions based on the list of practicals as given under. An examinee will be asked to write the programs and run on computer. Evaluation will be made on the basis of the examinee's performance in written solutions and presentation with viva-voce and practical record.

Practical Examination will be conducted externally as per the following distribution of marks:
Writing solutions of problems and
executing on the Computer: 20 marks.
Presentation &Viva voce: 10 marks.
Practical record: 10 marks.
Internal Assessment: 10 marks (Attendance=5 marks, Assignment=5 marks)

List of Practicals:

1. Usage of commands: ls, pwd, tty, cat, who, who am I, rm, mkdir, rmdir, touch, cd.
2. Usage of commands: cal, cat(append), cat(concatenate), mv, cp, man, date.
3. Usage of commands: chmod, grep, tput (clear, highlight), bc.
4. Write a shell script to check if the number entered at the command line is prime or not.
5. Write a shell script to modify "cal" command to display calendars of the specified months.
6. Write a shell script to modify "cal" command to display calendars of the specified range of months.
7. Write a shell script to accept a login name. If not a valid login name display message – "Entered login name is invalid".
8. Write a shell script to display date in the mm/dd/yy format.
9. Write a shell script to display on the screen sorted output of "who" command along with the total number of users.
10. Write a shell script to display the multiplication table any number.
11. Write a shell script to compare two files and if found equal asks the user to delete the duplicate file.
12. Write a shell script to find the sum of digits of a given number.
13. Write a shell script to merge the contents of three files, sort the contents and then display them page by page.
14. Write a shell script to find the LCD (least common divisor) of two numbers.
15. Write a shell script to perform the tasks of basic calculator.
16. Write a shell script to find the power of a given number.
17. Write a shell script to find the factorial of a given number.
18. Write a shell script to check whether the number is Armstrong or not.

Syllabi of B.Sc. with Computer Science 5th Semester
(w.e.f. 2021-22)

Paper Code	Paper Name	Type of Course	Credits (Theory/ Practical)	Contact Hours (Theory/ Practical)	Marks (External + Internal)
Choose One:	**Choose One:**	Discipline Specific Elective	3	3	40+10=50
20UCS501	Database Management Systems				
20UCS502	Discrete Structures				
20UCS503	Internet Technologies				
20UCS504	Artificial Intelligence				
Choose One:	**Choose One:**	Discipline Specific Elective	3	3	40+10=50
20UCS505	Software Engineering				
20UCS506	Computer Networks				
20UCS507	Computer Architecture & Organization				

20UCS501
Database Management Systems

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

Note: There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.

Objectives:
1. Be aware of basic concepts of data bases and data base management systems
2. Be aware of concepts of relational data bases.
3. Know to normalize relational data bases
4. Skilled in using relational algebra and relational calculus
5. Develop skills to write database queries.

Unit-I
Database system architecture: Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML).

Data models: Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.

Unit-II
Relational query languages: Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQL server.

Relational database design: Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Lossless design.

UNIT III
Transaction processing: Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery.

Query processing and optimization: Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.

UNIT IV

Database Security: Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection.

Advanced topics: Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.

Course Outcomes: After completion of course, students would be able to understand:

1. For a given query write relational algebra expressions for that query and optimize the developed expressions.
2. For a given specification of the requirement design the databases using E-R method and normalization.
3. For a given transaction-processing system, determine the transaction atomicity, consistency, isolation, and durability.
4. Implement the isolation property, including locking, time stamping based on concurrency control and serializability of scheduling.

Suggested Readings: –
a) **Text Books:**
1. Silberschatz A., Korth H. F. and Sudarshan S, Database System Concepts, 6th Edition, McGraw-Hill.
2. Elmasri R. and Navathe S., Fundamentals of Database Systems, 5th Edition, Pearson Education.

b) **Reference Books:**
1. Ullman J. D., Principles of Database and Knowledge–Base Systems, Vol 1, Computer Science Press.
2. Abiteboul S., Hull R. and Vianu V., Foundations of Databases, Addison-Wesley.

Note: - Every student has to practice the following list of practicals on the PC in the Computer Lab. The Examiner may ask questions in the final theory examinations based on the list of given practicals.

List of Practicals:
1. Create table, alter table, drop table
2. Select, update, delete, insert statements
3. Condition specification using Boolean and comparison operators (and, or, not,=,<>,>,<,>=,<=)
4. Arithmetic operators and aggregate functions (Count, sum, avg, Min, Max)
5. Multiple table queries (join on different and same tables)
6. Nested select statements
7. Set manipulation using (any, in, contains, all, not in, not contains, exists, not exists, union, intersect, minus, etc.)
8. Categorization using group by
9. Arranging using order by

Syllabi of B.Sc. with Computer Science 5th Semester
(w.e.f. 2021-22)

20UCS502
Discrete Structures

<div align="right">

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

</div>

Note: There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.

Objectives:
1. To introduce proof methods in mathematics and mathematical logic
2. To review concepts and techniques of set theory, relations and functions
3. To introduce various algebraic structures
4. To introduce graph theory
5. To develop an excitement in mathematics by highlighting its hidden beauty and significance

Unit-I
Introduction: Introduction to Sets, Finite and Infinite Sets, Unaccountably Infinite Sets. Introduction to Functions and relations, Properties of Binary relations, Closure, Partial Ordering Relations.

Unit-II
Pigeonhole Principle, Permutation and Combinations, Mathematical Induction, Principle of Inclusion and Exclusion.

Unit-III
Asymptotic Notations, Recurrence Relations: Introduction, Generating Functions, Linear Recurrence Relations with constant coefficients and their solution; **Inference Theory:** Introduction, Logical Connectives, Well Formed Formulas, Tautologies, Equivalence.

Unit-IV
Graphs Theory: Basic Terminology of Graphs, Models and Types, Multigraphs, Weighted Graphs, Graph Representation. Graph Isomorphism Graph Connectivity, Euler and Hamiltonian Paths and Circuits, Planar Graphs, Graph Coloring, Basic Terminology of Trees, Properties of Trees, Spanning Trees.

Course Outcome: After completion of course, students would be able to:
1. Learn the basic notions of Sets, Relation and Functions.
2. Study the methods of Pigeonhole Principle, Permutations and Combinations.
3. Implement the concept of Graph Theory.

Suggested Readings:
a) **Text Books:**
1. Liu C. L. and Mohapatra D. P., 2008. Elements of Discrete Mathematics, 3rd Edition, Tata McGraw Hill.
b) **Reference Books:**
1. Rosen K., 2007. Discrete Mathematics and its Applications, 6th Edition, Tata McGraw Hill.

2. Cormen T. H., Leiserson C. E. and Rivest R. L., 2010. Introduction to Algorithms, 3rd Edition, Prentice Hall of India.
3. Trembley J. P. and Manohar R., 2001. Discrete Mathematical Structures with Application to Computer Science, First Edition, Tata McGraw Hill.
4. Gries D. and Schneider F. B., 2010. A Logical Approach to Discrete Math, Springer.

Syllabi of B.Sc. with Computer Science 5th Semester
(w.e.f. 2021-22)

20UCS503
Internet Technologies

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

Note: *There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.*

Objectives:
1. To impart basic skills in moderately complex use of the following tools/scripts/languages: HTML, DHTML, Perl, CSS, JavaScript.
2. To impart necessary ability to choose the appropriate web tools/languages for creating state-of-the art websites.
3. To Expose students to current trends and styles in web design and applications.

Unit-I

Introduction to Web Design: Introduction to hypertext markup language (html) document type definition, creating web pages, graphical elements, lists, hyperlinks, tables, web forms, inserting images, frames.
Customized Features: Cascading style sheets, (CSS) for text formatting and other manipulations.

Unit-II

JavaScript: Data types, operators, functions, control structures, events and event handling.
Java: Use of Objects, Array and Array List class, Designing classes, Inheritance, Input/Output, Exception Handling.

Unit-III

JDBC: JDBC Fundamentals, Establishing Connectivity and working with connection interface, working with statements, Creating and Executing SQL Statements, Working with Result Set Objects.

Unit-IV

JSP: Introduction to JavaServer Pages, HTTP and Servlet Basics, The Problem with Servlets, The Anatomy of a JSP Page, JSP Processing, JSP Application Design with MVC, Setting Up the JSP Environment, Implicit JSP Objects, Conditional Processing, Displaying Values, Error Handling and Debugging, Sharing Data Between JSP Pages, Requests, and Users, Database Access.

Course Outcomes: After completion of course, students would be able to understand:
1. The client side and server side scripts used in programming
2. The basic concept of designing websites
3. Database connectivity with the web pages

Suggested Readings:
a) **Text Book:**
1. Schildt H., 2009. Java 7-The Complete Reference, 8th Edition.

2. Jain V. K., Advanced Programming in Web Design, Cyber Tech Publications.

b) Reference Book:

1. Bayross I., 2009. Web Enabled Commercial Application Development Using Html, Dhtml, JavaScript, Perl CGI, BPB Publications.
2. Horstmann C., 2009. BIG JAVA, 3rd Edition, Wiley Publication.
3. Keogh J., 2002. The Complete Reference J2EE, TMH.
4. Bergsten H., 2003. Java Server Pages, Third Edition, O'Reilly Media.

20UCS504
Artificial Intelligence

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

Note: *There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.*

Objectives:
1. To introduce the notion of machine intelligence.
2. To introduce the Symbolic processing paradigm of AI.
3. To introduce Knowledge representation formalism.
4. To introduce basic concepts and challenges of Speech and Language Processing.
5. To introduce basic concepts and challenges of Expert Systems.

Unit-I
Overview of Artificial Intelligence: What is AI, The importance of AI, Knowledge: Introduction, Definition and Importance of knowledge, Knowledge–Based Systems, Representation of Knowledge, Knowledge Organization, Knowledge Manipulation, Acquisition of Knowledge.

Unit-II
Formalized Symbolic Logics: Introduction, Syntax and Semantics for Propositional Logic and FOPL, Properties of Wff's, Conversion to Clausal Form, Inference Rules, The Resolution Principle; Structured Knowledge: Associative Networks, Frame Structures, Conceptual Dependencies and Scripts.

Unit-III
Search and Control Strategies: Preliminary concepts, Examples of Search Problems, Uniformed or blind Search, Informed Search, Searching And-Or graphs; Matching Techniques: Introduction, Structures Used in Matching, Measures for Matching, Partial Matching, The RETE Matching Algorithm.

Unit-IV
Natural Language Processing: Introduction, Overview of Linguistics, Grammars and Languages, Basic Parsing Techniques, Semantic Analysis and Representation Structures, Natural Language Generation, Natural Language Systems; Expert Systems: Introduction, Rule Based System Architecture, Knowledge Acquisition and Validation, Knowledge System Building Tools.

Course Outcomes: After completion of course, students would be able to:
1. Apply the basic principles, models, and algorithms of AI to recognize, model, and solve problems in the analysis and design of information systems.
2. Analyse the structures and algorithms of a selection of techniques related to searching, reasoning, machine learning, and language processing.

Suggested Readings:
a) **Text Books:**

1. Introduction to ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS, DAN W. PATTERSON, PHI Learning 2014.

b) **Reference Books:**

2. Artificial Intelligence, Third Edition, Elaine Rich, Kevin Knight, Shivashankar B. Nair, McGraw Hill Education (India) PVT LTD

Syllabi of B.Sc. with Computer Science 5th Semester
(w.e.f. 2021-22)

20UCS505
Software Engineering

Note: *There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.*

Objectives:
1. Understand the importance of basic processes in software Development life cycle.
2. Understand the various activities incorporate with different models and know their significance.
3. Familiarize the requirements in engineering and systematic approach in classical software design and development techniques.
4. Familiarize with various software testing techniques and tools.

Unit-I

Software Process: Introduction, S/W Engineering Paradigm, life cycle models (water fall, incremental, spiral, evolutionary, prototyping, object oriented), System engineering, computer based system, verification, validation, life cycle process, development process.

Software requirements: Functional and non-functional, user, system, requirement engineering process, requirements, elicitation, validation and management, software prototyping, prototyping in the software process, rapid prototyping techniques, user interface prototyping, S/W document. Analysis and modeling, data, functional and behavioral models, structured analysis and data dictionary.

Unit-II

Design Concepts and Principles: Design process and concepts, modular design, design model and document, Architectural design, software architecture, data design, architectural design, transform and transaction mapping, user interface design, user interface design principles, Real time systems, Real time software design, system design, real time executives, data acquisition system, monitoring and control system.

Unit-III

Software Project Management: Measures and measurements, S/W complexity and science measure, size measure, data and logic structure measure, information flow measure. Estimations for Software Projects, Empirical Estimation Models, Project Scheduling.

Unit-IV

Testing: Taxonomy of software testing, levels, test activities, types of s/w test, black box testing, testing boundary conditions, structural testing, test coverage criteria based on data flow, mechanisms, regression testing, testing in the large. S/W testing strategies, strategic approach and issues, unit testing, integration testing, validation testing, system testing and debugging.

Course Outcomes: After completion of course, students would be able to understand:

1. The software engineering practice over the entire system lifecycle.
2. Requirement engineering, analysis, prototyping, design, implementation, testing, maintenance activities and management of risks involved in software and embedded systems.

Suggested Readings:

a) **Text Books:**

1. Pressman R. S., Software Engineering- A Practitioner's Approach, McGraw-Hill
2. Jalote P., 1997, An Integrated Approach to Software Engineering, Springer Verlag.

b) **Reference Books:**

1. Sommerville I., 2000, Software engineering, 6th edition, Pearson education Asia.
2. Peters J. F. and Pedryez W., 2000, Software Engineering – An Engineering Approach, John Wiley and Sons, New Delhi.
3. Behforooz A. and Hudson F. J., 1996, Software Engineering Fundamentals, Oxford University Press, New Delhi.
4. Pfleeger, 1999, Software Engineering, Pearson Education India, New Delhi.
5. Ghezzi C, Jazayari M. and Mandrioli D., 1991, Fundamentals of Software Engineering, Prentice Hall of India, New Delhi.

Syllabi of B.Sc. with Computer Science 5th Semester
(w.e.f. 2021-22)

20UCS506
Computer Networks

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

Note: *There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.*

Objectives:
1. The basic transmission technologies and characteristics
2. The use of layer architecture for networking systems
3. The main design issues of transport protocols and the mechanism to control traffic flow and congestion.

Unit-I

Basic concepts: Components of data communication, standards and organizations, Network Classification, Network Topologies; network protocol; layered network architecture; overview of OSI reference model; overview of TCP/IP protocol suite.

Unit-II

Physical Layer: Cabling, Network Interface Card, Transmission Media Devices- Repeater, Hub, Bridge, Switch, Router, Gateway; **Data Link Layer:** Framing techniques; Error Control; Flow Control Protocols; Shared media protocols - CSMA/CD and CSMA/CA.

Unit-III

Network Layer: Virtual Circuits and Datagram approach, IP addressing methods – Subnetting; Routing Algorithms (adaptive and non-adaptive)

Transport Layer: Transport services, Transport Layer protocol of TCP and UDP

Unit-IV

Application Layer: Application layer protocols and services – Domain name system, HTTP, WWW, telnet, FTP, SMTP

Network Security: Cryptography Common Terms, Firewalls, Virtual Private Networks.

Course Outcomes: After completion of course, students would be able to understand:
1. Fundamental of Computer Networks
2. Basic Networking Protocols
3. Detailed understanding of various layers in OSI and TCP/IP reference models.

Suggested Readings:

a) **Text Books:**

1. Forouzan B. A., 2007, Data Communication and Networking, 4th Edition, Tata McGraw Hill.

b) **Reference Books**

1. Comer D. E., 1998, Internetworking with TCP/IP, Vol. I, Prentice Hall of India.
2. Stalling W., 2006, Data & Computer Communication, 8th edition, Prentice Hall of India.
3. Bertsekas D. and Gallager R., 1992, Data Networks, 2nd edition, Prentice Hall of India.

Syllabi of B.Sc. with Computer Science 5th Semester
(w.e.f. 2021-22)

20UCS507
Computer Architecture & Organization

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

Note: *There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.*

Objectives:
1. To get the basic concepts of Computers.
2. To get the functional knowledge about PC hardware, operations and concepts.
3. To understand the functional units of a standard PC and it's working.
4. To understand the memory organization in a computer.

Unit-I

Characteristics of Computer; Von Neumann model; Inside a Computer: SMPS, Motherboard, BIOS, CMOS, Ports and Interfaces, Expansion Cards, Ribbon Cables, ASCII; Types of Input Devices, Types of Output Devices.

Unit-II

Memory Representation, Hierarchy, Memory Units: RAM (SRAM, DRAM); ROM; Secondary Storage Devices: Magnetic Tape, Magnetic Disk, Types of Magnetic Disks, Optical Disk, Types of Optical Disks; USB: Pen drive, External Hard Disk; Memory Stick; CPU Registers, Cache Memory, Operations in Cache memory, hit ratio; Virtual Memory.

Unit-III

Instruction Format; Instruction Cycle: Fetch Cycle, Execution Cycle; Instruction Set: CISC Architecture, RISC Architecture, Comparison; Memory Chips: Pipelining and Parallel Processing; Microprogrammed Control and Hardwired Control.

Unit-IV

Input/Output Organization: Asynchronous Data Transfer, Programmed I/O (concepts only); Interrupts: Types of interrupts, processing interrupts, interrupt hardware and priority, DMA: DMA Controller, DMA Transfer Modes; I/O Processor.

Course Outcomes: After completion of course, students would be able to understand:
1. Concepts of Logic gates, flip flops and counter
2. Concept of Computer Architecture
3. Pipeline processing
4. RISC and CISC architectures
5. Develop a base for advance micro-processors

Suggested Readings:

a) **Text Books:**

1. Introduction to Information Technology, 2nd Edition, ITL Education Solutions Limited, Pearson.
2. John D.Carpinelli, Computer systems Organization & Architecture, Pearson Education.

b) **Reference Books:**

1. E.Balaguruswamy, Fundamentals of Computers, McGraw hill, 2014
2. Carl Hamacher, Vranesic, Zaky, Computer Organization 4th Edition, McGraw-Hill

Syllabi of B.Sc. with Computer Science 6th Semester
(w.e.f. 2021-22)

Paper Code	Paper Name	Type of Course	Credits (Theory/ Practical)	Contact Hours (Theory/ Practical)	Marks (External + Internal)
Choose One:	**Choose One:**	Discipline Specific Elective	3	3	40+10=50
20UCS601	Data Mining				
20UCS602	Mobile Computing and Applications				
20UCS603	E-Commerce Technologies				
20UCS604	Object Oriented Programming using C++				
Choose One:	**Choose One:**	Discipline Specific Elective	3	3	40+10=50
20UCS605	Cloud Computing				
20UCS606	Programming in JAVA & Lab (Credit: 2+1)				
20UCS607	Management Information Systems				
20UCS608	Project Work/Dissertation				

20UCS601
Data Mining

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs

Note: There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.

Objectives:
1. To get an understanding of the general properties of data in large databases
2. Understand a variety of real-world applications that require data mining
3. How to discover useful patterns and associations in huge quantities of data

Unit-I

Data Warehousing: Introduction- Definition and description, need for data ware housing, need for strategic information, failures of past decision support systems, OLTP vs DWH-DWH requirements-trends in DWH-Application of DWH.

Unit-II

Data Warehousing Architecture: Reference architecture- Components of reference Architecture-Data warehouse building blocks, implementation, physical design process and DWH deployment process. A Multidimensional Data, Model Data Warehouse Architecture.

Unit-III

Data Mining: Data mining tasks-Data mining vs KDD- Issues in data mining, Data Mining metrics, Data mining architecture - Data cleaning- Data transformation- Data reduction - Data mining primitives.

Association Rule Mining: Introduction - Mining single dimensional Boolean association rules from transactional databases - Mining multi-dimensional association rules.

Unit-IV

Classification and Prediction: Classification Techniques - Issues regarding classification and prediction-decision tree - Bayesian classification –Classifier accuracy – Clustering – Clustering Methods - Outlier analysis.

Applications and Other Data Mining Methods: Distributed and parallel Data Mining Algorithms, Text mining- Web mining.

Course Outcomes: After completion of course, students would be able to understand:

1. Different Data Mining techniques on the pre-processed data set for extracting hidden patterns from data.
2. Data mining algorithms to solve real world problems.
3. Different data mining techniques like classification, prediction, clustering, etc.

Suggested Readings:

a) **Text Books:**
1. Han J. and Kamber M., 2006. Data Mining Concepts and Techniques, Morgan Kaufmann Publishers, USA.
2. Berson, 2004. Data Warehousing, Data Mining and OLAP, Tata McGraw Hill Ltd, New Delhi.
b) **Reference Books:**
1. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Introduction to Data Mining, Pearson Education.
2. Pujari A. K., 2003. Data mining techniques, Oxford University Press, London.
3. Dunham M. H., 2003. Data mining: Introductory and Advanced Topics, Pearson Education, New Delhi.
4. Kantardzic M., 2003. Data Mining Concepts, Methods and Algorithms, John Wiley and Sons, USA.
5. Soman K. P., Diwakar S. and Ajay V., 2006. Insight into Data mining: Theory and Practice, PHI.

Syllabi of B.Sc. with Computer Science 6th Semester
(w.e.f. 2021-22)

20UCS602
Mobile Computing and Applications

Note: There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.

Objectives:
1. To understand the basic concepts of Mobile Computing.
2. To learn the basics of mobile telecommunication.
3. Exposure to Ad-Hoc networks.

Unit-I

Event Driven Programming: UI event loop, Threading for background tasks, Outlets/actions, delegation, notification, Model View Controller (MVC) design pattern.

Mobile application issues: limited resources (memory, display, network, file system), input/output (multi-touch and gestures), sensors (camera, compass, accelerometer, GPS)

Unit-II

Development tools: Apple iOS toolchain: Objective-C, Xcode IDE, Interface Builder, Device simulator.
Frameworks: Objective-C and Foundation Frameworks, Cocoa Touch, UIKit, Others: Core Graphics, Core Animation, Core Location and Maps, Basic Interaction.

Unit-III

Common UI's for mobile devices: Navigation Controllers, Tab Bars, Table Views, Modal views, UI Layout. **Data Persistence:** Maintaining state between application invocations, File system, Property Lists, SQLite, Core Data

Unit-IV

Remote Data-Storage and Communication: Back End/server side of application, RESTful programming, HTTP get, post, put, delete, database design, server side JavaScript / JSON.
Code signing: security, Keychain, Developers and App Store License Agreement.

Course Outcomes: After completion of course, students would be able to understand:
1. concepts and features of mobile computing technologies and applications.

2. underlying wireless and mobile communication networks work, their technical features, and what kinds of applications they can support.
3. The important issues of developing mobile computing systems and applications;
4. organize and manage software built for deployment and demonstration.

Suggested Readings:
   a) Text Books:
1. Pattnaik P. K. and Mall R., 2012. Fundamentals of Mobile Computing, PHI Learning Pvt. Ltd., New Delhi.

   b) Reference Books:
1. Ramnath R., Crawfis R. and Sivilotti P., 2011. Android SDK 3 for Dummies, Wiley.
2. Lee V., Schneider H. and Schell R., 2004. Mobile Applications: Architecture, Design, and Development, Prentice Hall.
3. Fling B., 2009. Mobile Design and Development, O'Reilly Media.
4. Firtman, 2010. Programming the Mobile Web, O'Reilly Media.
5. Crumlish C. and Malone E., 2009. Designing Social Interfaces, O'Reilly Media.

20UCS603
E-Commerce Technologies

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

Note: There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.

Objectives:
1. To study the concepts of E-commerce Online transactions.
2. To learn the e-commerce transactions by making it Safe and Secure.
3. Learning of Safe and secure solutions in the payment method.

Unit-I

An introduction to Electronic commerce: What is E-Commerce (Introduction and Definition), Main activities E-Commerce, Goals of E-Commerce, Technical Components of E-Commerce, Functions of E-Commerce, Advantages and disadvantages of E-Commerce, Scope of E- Commerce, Electronic Commerce Applications, Electronic Commerce and Electronic Business (C2C, C2G, G2G, B2G, B2P, B2A, P2P, B2A, C2A, B2B, B2C)

Unit-II

The Internet and WWW: Evolution of Internet, Domain Names and Internet Organization (.edu, .com, .mil, .gov, .net etc.), Types of Network, Internet Service Provider, World Wide Web, Internet & Extranet, Role of Internet in B2B Application, building own website, Cost, Time, Reach, Registering a Domain Name, Web promotion, Target email, Exchange, Shopping Bots

Unit-III

Internet Security: Secure Transaction, Privacy on Internet, Computer Crime, Threats, Attack on Computer System, Computer Virus.
Electronic Data Exchange: Introduction, Concepts of EDI and Limitation, Applications of EDI, Disadvantages of EDI, EDI model, Electronic Payment System: Introduction, Types of Electronic Payment System, Payment Types, Value Exchange System, Credit Card System, Electronic Fund Transfer, Paperless bill, Modern Payment Cash, Electronic Cash

Unit-IV

Planning for Electronic Commerce: Planning Electronic Commerce initiates, linking objectives to business strategies, measuring cost objectives, comparing benefits to Costs, Strategies for developing electronic commerce web sites

Internet Marketing: The PROS and CONS of online shopping, Justify an Internet business, Internet

marketing techniques, The E-cycle of Internet marketing, Personalization e-commerce.

Course Outcomes: After completion of course, students would be able to understand:

1. To understand the complexity of e-commerce and its many facets.
2. To explore how e-business and e-commerce fit together.
3. To identify the impact of e-commerce.
4. To recognise the benefits and limitations of e-commerce.
5. To use classification frameworks for analysing e-commerce

Suggested Readings:

a) **Text Books:**

4. G.S.V. Murthy, 2011. E-Commerce Concepts, Models, Strategies, Himalaya Publishing House.

b) **Reference Books:**

1. Kamlesh K Bajaj and Debjani Nag, 2005. E- Commerce.
2. Gray P. Schneider, 2011. Electronic commerce, International Student Edition.
3. Chan H., Lee R., Dillon T. and Chang E., 2011. E-Commerce, Fundamentals and Applications, Wiley Student Edition.

Syllabi of B.Sc. with Computer Science 6th Semester
(w.e.f. 2021-22)

20UCS604
Object Oriented Programming using C++

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

Note: There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.

Objectives:
1. To understand how C++ improves C with object-oriented features.
2. To learn how to write inline functions for efficiency and performance.
3. To learn the syntax and semantics of the C++ programming language.
4. To learn how to design C++ classes for code reuse.

Unit-I

Introduction to object oriented programming: Procedural vs. Object oriented programming, Characteristics of OOP: Objects, classes, Encapsulation, Data Abstraction, Inheritance, Polymorphism, Dynamic Binding, and Message Passing. Structure of C++ program: Data-types, Variables, Static Variables, Operators in C++, Arrays, Strings, Structure, Functions, Recursion, Control Statements.

Unit-II

Introduction to Class: Class Definition, Classes and Objects, Access Specifiers: Private, Public and Protected, Member functions of the class, Constructor and Destructor, Parameterized Constructor, Copy Constructors, Inheritance: Reusability, Types of Inheritance: Single inheritance, Multiple, Multilevel, Hybrid Inheritance, Public, Private, and Protected Derivations, Constructor and destructor in derived class, Object initialization and conversion, Nested classes.

Unit-III

Polymorphism: Function Overloading, Static Class Members, Static Member Functions, Friend Functions, Operator Overloading: Unary and Binary Operator Overloading. Abstract class, Virtual function, Pure virtual function, Overloading vs. Overriding. Memory management: new, delete, object Creation at Run Time, This Pointer. Exception handling: Throwing, Catching, Re-throwing an exception, specifying exceptions, processing unexpected exceptions, Exceptions when handling exceptions.

Unit-IV

Templates: Introduction, Class templates and Function templates, Overloading of template function, namespaces. Introduction to STL: Standard Template Library: benefits of STL, containers, adapters, iterator, vector, list. Working with files: C++ streams, C++ stream classes, creating, opening, closing and deleting files, file pointers and their manipulators, Error handling during file operations.

Course Outcomes: After completion of course, students would be able to understand:

1. Difference between the top-down and bottom-up approach.
2. Concepts of Object Oriented Programming.
3. Object-oriented programming approach in connection with C++.
4. Data file manipulations using C++.
5. Virtual and pure virtual function and Complex programming situations.

Suggested Readings:

a) Text Books:
1. Schildt H., C++ - The Complete Reference, Tata McGraw Hill Publications.
2. Balaguruswamy E., Object Oriented Programming and C++, TMH.

b) Reference Books:
1. Balaguruswamy E., C++, Tata McGraw Hill Publications.
2. Shah and Thakker: Programming in C++, ISTE/EXCEL.
3. Johnston: C++ Programming Today, PHI.

Syllabi of B.Sc. with Computer Science 6th Semester
(w.e.f. 2021-22)

20UCS605
Cloud Computing

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

Note: There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.

Objectives:
1. To introduce the broad perceptive of cloud architecture & model.
2. To explore the fundamental concepts of big data analytics.
3. To introduce basics of edge computing and application.
4. How problems solved using soft computing.

Unit-I

Cloud Introduction: Cloud Computing Fundamentals: Cloud Computing definition, Types of cloud, Cloud services: Benefits and challenges of cloud computing, Evolution of Cloud Computing usage scenarios and Applications, Business models around Cloud– Major Players in Cloud Computing - Issues in Cloud - Eucalyptus - Nimbus - Open Nebula, CloudSim.

Unit-II

Cloud Services and File System: Types of Cloud services: Software as a Service - Platform as a Service – Infrastructure as a Service - Database as a Service - Monitoring as a Service – Communication as services. Service providers- Google App Engine, Amazon EC2, Microsoft Azure, Sales force. Introduction to MapReduce, GFS, HDFS, Hadoop Framework.

Unit-III

Collaborating with Cloud: Collaborating on Calendars, Schedules and Task Management– Collaborating on Event Management, Contact Management, Project Management – Collaborating on Word Processing, Databases – Storing and Sharing Files- Collaborating via Web-Based Communication Tools – Evaluating Web Mail Services – Collaborating via Social Networks – Collaborating via Blogs and Wikis. 185 CS-Engg&Tech-SRM-2013

Unit-IV

Virtualization for Cloud: Need for Virtualization–Pros and cons of Virtualization–0Types of Virtualization–System Vm, Process VM, Virtual Machine monitor–Virtual machine Properties- Interpretation and binary translation, HLL VM - Hypervisors – Xen, KVM, VMWare, Virtual Box, Hyper-V. **Security, Standards, And Applications:** Security in Clouds: Cloud security challenges, Common Standards: The Open Cloud Consortium.

Course Outcomes: After completion of course, students would be able to understand:

1. The core concepts of the cloud computing paradigm;
2. Various models and services in cloud computing
3. System virtualization and outline its role in enabling the cloud computing system model.
5. Fundamental concepts of cloud storage and demonstrate their use in storage systems.
6. Analyze various cloud programming models and apply them to solve problems on the cloud

Suggested Readings:

a) **Text Books:**

1. Bloor R., Kanfman M., Halper F. and Hurwitz J., 2010. Cloud Computing, Wiley India Edition

b) **Reference Books:**

1. Rittinghouse J. & Ransome J., 2010. Cloud Computing Implementation Management and Strategy, CRC Press.

2. Velte A. T., 2009. Cloud Computing: A Practical Approach, McGraw Hill.

3. Miller M., 2008. Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online, Que Publishing.

4. Smith J. E. and Nair R., 2006. Virtual Machines, Morgan Kaufmann Publishers.

Syllabi of B.Sc. with Computer Science 6th Semester
(w.e.f. 2021-22)

20UCS606
Programming in JAVA

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

Note: *There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.*

Objectives:
1. Students will learn to install and work with JDK, also make them aware the use of java doc.
2. Students will practice basic data types, operators and control structures in Java
3. Practice basic handling of classes and objects in Java
4. Introduce the following selected APIs: I/O, Strings, Threads, AWT, Applet, Networking
5. Idea to approach and use a new package

Unit-I
Introduction to Java: Features of Java, JDK Environment; **Java Programming Fundamental:** Structure of java program, Data types, Variables, Operators, Keywords, Naming Convention, Decision Making (if, switch), Looping (for, while), Type Casting; **Object Oriented Programming Concept:** Overview of Programming, Paradigm, Classes, Abstraction, Encapsulation, Inheritance, Polymorphism, Difference between C++ and JAVA.

Unit-II
Classes and Objects: Creating Classes and objects, Memory allocation for objects, Constructor, Implementation of Inheritance, Implementation of Polymorphism, Method Overloading, Method Overriding, Nested and Inner classes

Unit-III
Arrays and Strings: Arrays, Creating an array, Types of Arrays, String class Methods, String Buffer methods.
Abstract Class, Interface and Packages: Modifiers and Access Control, Abstract classes and methods, Interfaces, Packages Concept, creating user defined packages

Unit-IV
Exception Handling: Exception types, using try catch and multiple catch, Nested try, throw, throws and finally, Creating User defined Exceptions; **File Handling:** Byte Stream, Character Stream, File IO Basics, File Operations, creating file, reading file, Writing File; **Applet Programming:** Introduction, Types Applet, Applet Life cycle, Creating Applet, Applet tag.

Course Outcomes: After completion of course, students would be able to understand:
1. Concepts of Object Oriented Programming (OOPS).
2. Classes and Objects in JAVA.
3. Concepts of Exceptional Handling

Suggested Readings:

a) Text Book:

1. Schildt, H., 2009. Java 7, 8th Edition, The Complete Reference.

b) Reference Books:

1. Horstmann, C., 2009. BIG Java, 3rd Edition Wiley Publication.
2. Balagurusamy, E., 2007. Programming with JAVA, TMH.

Note: - Every student has to practice the following list of practicals on the PC in the Computer Lab. The Examiner may ask questions in the final theory examinations based on the list of given practicals.

List of Practicals:

1. Simple programs to demonstrate the syntax and use of the following features of the language: basic data types, operators and control structures.
2. Program related to Class definitions and usage involving variety of constructors and finalizers
3. Programs involving various kinds of inheritances.
4. Program involving Method Over-riding, Method Over-loading
5. Program involving Abstract Class and Methods
6. Program involving Interface.
7. Program to demonstrate creation and handling of packages, their imports and Class Path.
8. Programs involving a variety of Exception Handling situations
9. Program to define a class that generates Exceptions and using objects of the class.
10. Program involving creating and handling threads in applications and applets.
11. Programs to demonstrate methods of various i/o classes
13. Programs to demonstrate methods of string class
14. Program to demonstrate AWT/Swing graphic methods
15. Program for Loading and Viewing Images, Loading and Playing Sound
16. Programs to demonstrate various Layouts
17. Programs to demonstrate event handling.

20UCS607
Management Information System

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

Note: There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.

Objectives:
This course will equip students with skills to analysis information requirements for managerial decision making.

Unit-I

Data and Information. MIS- need and concepts, factors influencing MIS and characteristics of MIS. Technology of MIS. Structure of MIS. Decision Making and role of MIS. Data communication. Basic H/W required, Channel features and concept of Distributed Databases Decision Support System: Overview, components and classification, steps in constructing a DSS, role in business, group decision support system.

Unit-II

Information system for strategic advantage, strategic role for information system, breaking business barriers, business process reengineering, improving business qualities.

Unit-III

Planning for MIS; System Development Methodologies; Conceptual and detailed designs of MIS. Information system analysis and design, information SDLC, hardware and software acquisition, system testing, documentation and its tools, conversion methods.

Unit-IV

System implementation Strategies and process; System Evaluation and Maintenance. Applications – cross–functional MIWS; ERP; CRM; SCM; Transaction Processing; Artificial Intelligence technologies in business: neural network, fuzzy logic, virtual reality; Executive information system.

Course Outcomes: After completion of course, students would be able to understand:
1. Understand the leadership role of Management Information Systems in achieving business competitive advantage through informed decision making.
2. Analyze and synthesize business information and systems to facilitate evaluation of strategic alternatives.
3. Effectively communicate strategic alternatives to facilitate decision making.

Suggested Readings:
a) **Text Books:**
1. Brien, James, Management Information System, Tata McGraw Hill, Delhi.
2. Stair, Principles of Management System, Thomson Learning, Bombay.
b) **Reference Books:**

1. Jawadekar, Management Information Systems, TMH, N Delhi.
2. Mckeown, Information Technology and the Networked Economy, Thomson Learning, Bombay.
3. Brady, Cases in MIS, Thomson Learning, Bombay.
4. Murdick & Ross, Management Information System, PHI, Delhi.
5. Kanter, J., Management Information System, PHI, Delhi.

Syllabi of B.Sc. with Computer Science 6th Semester
(w.e.f. 2021-22)

20UCS608
Project Work/Dissertation

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

Instructions regarding Project Work/Dissertation:

- This option is to be offered only in 6th Semester.
- The students will be allowed to work on any project based on the concepts studied in core/elective or skill based elective courses.
- The group size should be maximum of three (03) students.
- Each group will be assigned a teacher as a supervisor who will handle both their theory as well lab classes.
- A maximum of Four (04) projects would be assigned to one teacher.
- Theory classes will cover project management techniques.

Skill Enhancement Courses
Syllabi of B.Sc. with Computer Science 4th Semester
(w.e.f. 2021-22)

Paper Code	Paper Name	Type of Course	Credits (Theory/ Practical)	Contact Hours (Theory/ Practical)	Marks (External + Internal)
Choose One:	Choose One:	Skill Enhancement	3	3	40+10=50
20USECCS401	Office Automation Tools				
20USECCS402	HTML Programming				
20USECCS403	MySQL				
20USECCS404	Multimedia and Applications				

20USECCS401
Office Automation Tools

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

Note: There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.

Objectives:
1. Students will learn the concept of MS Office.
2. To learn and practice some of the IT tools i.e. MS Word, MS Excel and MS PowerPoint.

Unit-I
Introduction to open office/MS office/Libre office, features, properties and applications.

Unit-II
Word Processing: Formatting Text, Pages, Lists, Tables, Graphics, Inserting Videos, Mail Merge.

Unit-III
Spreadsheets: Worksheets, formatting data, creating charts and graphs, using formulas and functions, macros, Pivot Table.

Unit-IV
Presentation Tools: Adding and formatting text, pictures, graphic objects, including charts, objects, formatting slides, notes, hand-outs, slide shows, using transitions, animations.

Course Outcomes: After completion of course, students would be able to:
1. perform documentation
2. perform accounting operations
3. perform presentation skills

Suggested Readings:

a) **Text Book:**

1. Madan S., 2009. Introduction to Essential tools, JBA.
2. Goel A., 2012. Computer Fundamentals, Pearson.

b) **Reference Books:**

1. Kumar A., 2011. Computer Basics with Office Automation, I K International Publishing House Pvt. Ltd.
2. Schwartz S., 2013. Microsoft Office 2013: Visual Quick Start Guide, 1st Edition, Pearson Education.

Skill Enhancement Courses
Syllabi of B.Sc. with Computer Science 4th Semester
(w.e.f. 2021-22)

20USECCS402
HTML Programming

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

Note: There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.

Objectives:
1. To impart basic skills in moderately complex use of the following tools/scripts/languages: HTML, DHTML, Perl, CSS, JavaScript.
2. To impart necessary ability to choose the appropriate web tools/languages for creating state-of-the art websites.
3. To Expose students to current trends and styles in web design and applications.

Unit-I

Introduction, The Basics, The Head, the Body, Colors, Attributes, basic formatting tags - heading, paragraph, underline break, bold, italic, underline, superscript, subscript, font and image. Attributes - align, color, bgcolor, font face, border, size. Lists - ordered, unordered and definition, Table tag.

Unit-II

Navigation Links using anchor tag - internal, external, mail and image links, Relative Links, Absolute Links, Link Attributes, Using the ID Attribute to Link Within a Document.

Unit-III

Images: Putting an Image on a Page, Using Images as Links, Putting an Image in the Background Tables: Creating a Table, Table Headers, Captions, Spanning Multiple Columns, Styling Table.

Unit-IV

Forms: Basic Input and Attributes, Other Kinds of Inputs, Styling forms with CSS, where to Go from Here, HTML Form controls - form, text, password, text area, button, checkbox, radio button, select box, hidden controls.

Course Outcomes: After completion of course, students would be able to:
1. Use knowledge of HTML and CSS code and an HTML editor to create personal and/or business websites following current professional and/or industry standards.
2. Use critical thinking skills to design and create websites.
3. Use a stand-alone FTP program to upload files to a web server.

Suggested Readings:
a) **Text Books:**
1. Introduction to HTML and CSS -- O'Reilly, 2010
b) **Reference Books:**

1. Duckettm J., 2012. HTML and CSS, John Wiley.
2. Gill N. S., Essentials of Computer and Network Technology, Khanna Books Publishing Co., New Delhi.
3. Young M. L., Internet – The Complete Reference.
4. Hahn H., The Internet – Complete Reference, TMH.

Skill Enhancement Courses
Syllabi of B.Sc. with Computer Science 4ᵗʰ Semester
(w.e.f. 2021-22)

20USECCS403
MySQL

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

Note: There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.

Objectives:
1. To impart basic skills in moderately complex use of the following tools/ scripts/ languages.
2. To choose the appropriate web tools/languages for creating state-of-the art web sites.
3. To expose students to current trends and styles in web design and applications.

Unit-I

SQL Vs. SQL * Plus: SQL Commands and Data types, Operators and Expressions, Introduction to SQL * Plus. Managing Tables and Data: Creating and Altering Tables (Including constraints).

Unit-II

Data Manipulation Command like Insert, update, delete, SELECT statement with WHERE, GROUP BY and HAVING, ORDER BY, DISTINCT, Special operator like IN, ANY, ALL BETWEEN, EXISTS, LIKE.

Unit-III

Join, Built in functions, Other Database Objects: View, Synonyms, Index.
Transaction Control Statements: Commit, Rollback, Savepoint.

Unit-IV

Introduction to PL/SQL: SQL v/s PL/SQL, PL/SQL Block Structure, Language construct of PL/SQL (Variables, Basic and Composite Data type, Conditions looping etc.), % TYPE and % ROWTYPE, Using Cursor (Implicit, Explicit).

Course Outcomes: After completion of course, students would be able to:
1. Establish a basic understanding of the analysis and design of a database.
2. Establish a basic understanding of the process of Database Development and Administration using SQL.
3. Enhance Programming and Software Engineering skills and techniques using SQL.
4. Establish a basic understanding of background materials needed for technical support using SQL.

Suggested Readings:

a) Text Books:

1. Schwartz B., 2012. High Performance MySQL, O'Reilly.
2. Ullman L., 2014. PHP and MySQL for Dynamic Web Sites: Visual QuickPro Guide, 4th Edition, Pearson Education India.

b) **Reference Books:**

1. Vaswani V., 2004. The Complete Reference MySQL, McGraw Hill Educations.
2. Welling L. and Thomson L., 2016. PHP and MySQL Web Development, 5th Edition, Pearson Education.

Skill Enhancement Courses
Syllabi of B.Sc. with Computer Science 4th Semester
(w.e.f. 2021-22)

20USECCS404
Multimedia and Applications

Note: *There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.*

Objectives:
1. Study of features of text, audio, images, video and active contents.
2. Familiar with the file formats for the above elements.
3. Aware of various application softwares used to process the above elements.
4. Aware of various applications of multimedia.

Unit-I

Multimedia: Introduction to multimedia, Components, Uses of multimedia.
Making Multimedia: Stages of a multimedia project, Requirements to make good multimedia, Multimedia Hardware- Macintosh and Windows production Platforms, Hardware peripherals-Connections, Memory and storage devices, Multimedia software and Authoring tools.

Unit-II

Text: Fonts & Faces, Using Text in Multimedia, Font Editing & Design Tools, Hypermedia &Hypertext.
Sound: Digital Audio, MIDI Audio, MIDI vs Digital Audio, Audio File Formats.

Unit-III

Images: Still Images – Bitmaps, Vector Drawing, 3D Drawing & rendering, Natural Light & Colors, Computerized Colors, Color Palletes, Image File Formats.

Unit-IV

Video: How Video Works, Analog Video, Digital Video, Video File Formats, Video Shooting and Editing.
Animation: Principle of Animations, Animation Techniques, Animation File Formats.

Course Outcomes: After completion of course, students would be able to:
1. Identify and describe the function of the general skill sets in the multimedia industry.
2. Identify the basic components of a multimedia project.
3. Identify the basic hardware and software requirements for multimedia development and playback.

Suggested Readings:
  a) **Text Books:**
  1. Steinmetz R. and Naharstedt K., 1995, Multimedia: Computing, Communications

Applications, Pearson.

b) **Reference Books:**

1. Vaughan T., 2006. Multimedia: Making it work, Eighth edition, TMH.
2. Keyes, 2000. Multimedia Handbook, TMH.
3. Andleigh K. and Thakkar K., 2000. Multimedia System Design, PHI.

Skill Enhancement Courses
Syllabi of B.Sc. with Computer Science 5th Semester
(w.e.f. 2021-22)

Paper Code	Paper Name	Type of Course	Credits (Theory/ Practical)	Contact Hours (Theory/ Practical)	Marks (External + Internal)
Choose One:	Choose One:	Skill Enhancement	3	3	40+10=50
20USECCS501	PHP Programming				
20USECCS502	Programming in Visual Basic				
20USECCS503	System Administration and Maintenance				
20USECCS504	Programming in SCILAB				

20USECCS501
PHP Programming

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

Note: There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.

Objectives:
1. To impart basic skills in moderately complex use of the following tools/ scripts/ languages:
2. To choose the appropriate web tools/languages for creating state-of-the art web sites.

Unit-I

PHP introduction, inventions and versions, important tools and software requirements (like Web Server, Database, Editors etc.), PHP with other technologies, scope of PHP, Basic Syntax, PHP variables and constants, Types of data in PHP, Expressions, scopes of a variable (local, global), PHP Operators: Arithmetic, Assignment, Relational, Logical operators, Bitwise, ternary and MOD operator, PHP operator Precedence and associativity

Unit-II

Handling HTML form with PHP: Capturing Form Data, GET and POST form methods, dealing with multi value fields, Redirecting a form after submission.

PHP conditional events and Loops: PHP IF Else conditional statements (Nested IF and Else), Switch case, while, For and Do While Loop, Goto, Break, Continue and exit.

Unit-III

PHP Functions: Function, Need of Function, declaration and calling of a function, PHP Function with arguments, Default Arguments in Function, Function argument with call by value, call by reference Scope of Function: Global and Local.
Array: Creating index based and Associative array, accessing array, looping with Index based array, with associative array using each () and foreach (), Some useful Library function.

Unit-IV

String Manipulation and Regular Expression: Creating and accessing String, Searching & Replacing String, Formatting, joining and splitting String, String Related Library functions, Use and advantage of regular expression over inbuilt function, Use of preg_match(), preg_replace(), preg_split() functions in regular expression.

Course Outcomes: After completion of course, students would be able to:
1. Write PHP scripts to handle HTML forms.
2. Write regular expressions including modifiers, operators, and metacharacters.
3. Create PHP programs that use various PHP library functions, and that manipulate files and directories.
4. Analyze and solve various database tasks using the PHP language.
5. Analyze and solve common Web application tasks by writing PHP programs.

Suggested Readings:
a) **Text Books:**
1. Learning PHP, MySQL, books by ' O' riley Press.
2. Beighley L. and Morrison M., 2009. Head First PHP & MySQL, 1st Edition, O'Reilly Press.

b) **Reference Books:**
1. Yank K., 2012. PHP & MySQL-Novice to Ninja, 5th Edition, SitePoint.
2. Forbes A., 2012. The Joy of PHP: A Beginner's Guide to Programming Interactive Web Applications with PHP and MySQL, 6th Edition, BeakCheck LLC.
3. Vasvani V., 2008. PHP: A Beginner's Guide, McGraw-Hill Education.

Skill Enhancement Courses
Syllabi of B.Sc. with Computer Science 5th Semester
(w.e.f. 2021-22)

20USECCS502
Programming in Visual Basic

<div align="right">
Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.
</div>

Note: *There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.*

Objectives:
1. Students will be able to analyze program requirements of Visual Basic
2. Design/develop programs with GUI interfaces
3. Code programs and develop interface using Visual Basic .Net
4. Perform tests, resolve defects and revise existing code

Unit-I

GUI Environment: Introduction to graphical user interface (GUI), programming language (procedural, object oriented, event driven), the GUI environment, compiling, debugging, and running the programs.

Operations: Data types, constants, named & intrinsic, declaring variables, scope of variables, val function, arithmetic operations, formatting data.

Unit-II

Controls: Introduction to controls textboxes, frames, check boxes, option buttons, images, setting borders and 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.

Unit-III

Decision Making: If 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.

Unit-IV

Forms Handling: Multiple forms creating, adding, removing forms in project, hide, show method, load, unload statement, me keyword, referring to objects on a different form. Database connectivity with the form.

Iteration Handling: Do/loops, for/next loops, using msgbox function. Using string function.

Course Outcomes: After completion of course, students would be able to:
1. Explain basic concepts and definitions of Visual Basic
2. Express constants and arithmetic operations.

3. Distinguish variable and data types.
4. Students code visual programs by using Visual Basic work environment.
5. Students prepare various projects by helping visual programming.

Suggested Readings:
  a) **Text Books:**
  1. Bradley J. C. and Millispangh A. C., 2000. Programming in Visual Basic 6.0, Tata McGraw Hill Edition.
  b) **Reference Books:**
  1. Hoisington C., 2017. Microsoft Visual Basic 2017 for Windows, Web, and Database Applications: Comprehensive, 1st Edition, Cengage Learning.
  2. Schneider D.I., 2019. Introduction to Programming Using Visual Basic, 11th Edition, Pearson.
  3. McGrath M., 2019. Visual Basic in easy steps, 6th Edition.

Skill Enhancement Courses
Syllabi of B.Sc. with Computer Science 5th Semester
(w.e.f. 2021-22)

20USECCS503
System Administration and Maintenance

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

Note: *There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.*

Objectives:
1. Explain the internal working of the system.
2. Discuss the principles of assemblers and narrate the working of loaders and linkers.
3. Discuss system development tools
4. Learn the concept of Linux and Windows systems.

Unit-I
Basics of operating system, services, Installation and configuration, maintenance.
Linux/Unix: What is Linux/Unix Operating systems, Kernel, API, CLI, GUI, Difference between Linux/Unix and other operating systems, Features and Architecture, Linux features, advantages, disadvantages.

Unit-II
Linux Systems: Booting and Shutting Down processes, Rootly Powers, Controlling Processes, The File System, Adding New Users, Periodic Processes, Syslog and Log Files.

Unit-III
Windows: Windows as operating system, history, versions, PC hardware, BIOS, Devices and drivers, Kernal Configuration and building, Application installation, configuration and maintenance, Server services and Client services, Difference between Windows XP/windows 7 and windows server 2003/2008.

Unit-IV
Windows Systems: Maintenance Strategies and Administrative Practices, Basics of Data Backup and Restore, Understanding and configuring Active Directory Domain services, Creating Active Directory groups, Organizational Units, and Sites, adding client computers and member servers to the domain, deploying group policy and network access, Working with network shares and the distributed file system.

Course Outcomes: After completion of course, students would be able to:
1. Explain how a modern Unix-based system is constructed.
2. rapidly locate, evaluate and structure information in standards, technical documentation and professional literature to create solutions to new problems.
3. design, implement and maintain a computer system suitable for a small office or company.
4. test and troubleshoot services and other functionality in a small computer system.

Suggested Readings:

a) **Text Books:**

1. Bragg R., Windows Server 2003 Security: A Technical Reference. Addison-Wesley.
2. Nemeth E., Snyder G. and Hein T. R., Linux Administration Handbook, Second Edition, Prentice Hall.

b) **Reference Books:**

1. Nemeth E., Snyder G., Hein T. R., Whaley B. and Mackin D., 2019. Unix and Linux Handbook, 5th Edition, Pearson Education.
2. Colling T. and Wall K., 2005. Red Hat Linux Networking & System Administration, 3rd Edition, Wiley.

Skill Enhancement Courses
Syllabi of B.Sc. with Computer Science 5th Semester
(w.e.f. 2021-22)

20USECCS504
Programming in SCILAB

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

Note: There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.

Objectives:
1. Students will learn about the SCILAB and their applications.
2. Studying of Plotting and Mathematical computations.

Unit-I

Introduction to Programming: Components of a computer, working with numbers, Machine code, Software hierarchy.
Programming Environment: SCILAB Environment, Workspace, Working Directory, Expressions, Constants, Variables and assignment statement, Arrays.

Unit-II

Graph Plots: Basic plotting, built in functions, generating waveforms, Sound replay, load and save. Matrices and Some Simple Matrix Operations, Sub- Matrices.

Unit-III

Procedures and Functions: Arguments and return values.
Control Statements: Conditional statements: If, Else, Else-if, Repetition statements: While, for loop.

Unit-IV

Manipulating Text: Writing to a text file, reading from a text file, Randomizing and sorting a list, searching a list.

Course Outcomes: After completion of course, students would be able to understand:
1. about SCILAB software environment.
2. the basics of SCILAB software and its data class.
3. basic SCILAB programming for engineering application.
4. SCILAB Simulink for simulation, analysis and design of the system.

Suggested Readings:
a) **Text Books:**
1. Ramchandran H. and Nair A. S., 2011, SCILAB, S. Chand.
2. Goyal R. and Aggarwal M., 2019, Programming in SCILAB, Alpha Science International Ltd.
b) **Reference Books:**
1. Affouf M., 2012. SCILAB by Example, Create Space Independent Publishing Platform.
2. Nagar S., 2017. Introduction to Scilab: For Engineers and Scientists, 1st Edition, APRESS.

Skill Enhancement Courses
Syllabi of B.Sc. with Computer Science 6ᵗʰ Semester
(w.e.f. 2021-22)

Paper Code	Paper Name	Type of Course	Credits (Theory/ Practical)	Contact Hours (Theory/ Practical)	Marks (External + Internal)
Choose One:	Choose One:	Skill Enhancement	3	3	40+10=50
20USECCS601	Software Testing Concepts				
20USECCS602	Android Programming				
20USECCS603	XML Programming				
20USECCS604	R Programming				

20USECCS601
Software Testing Concepts

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

Note: There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.

Objectives:
1. Discuss the basic concept of testing.
2. Explain the different types of testing.
3. Describe the tools used for testing

Unit-I

Software Testing: Basics of software testing, Strategic Approach to Software Testing, Testing objectives, Test Strategies for Conventional Software, Principles of testing, Testing and debugging, Test metrics and measurements, STLC, Verification, Validation, Software Quality and Reliability, V Shaped Software Lifecycle Model.

Unit-II

Functional and non-functional Testing: system testing, recovery testing, security testing, stress testing, performance testing, usability testing, White box testing, static testing, static analysis tools.

Unit-III

Structural testing: Unit/Code functional testing, Code coverage testing, Code complexity testing, Black Box testing, Requirements based testing, Boundary value analysis, Equivalence partitioning, state/graph based testing, Scenario Testing, Alpha, Beta and Acceptance Testing: Acceptance criteria; test cases selection and execution, Decision Table Based Testing.

Unit-IV

Basis Path Testing: Program Graph, DD Path graph, Cyclomatic Complexity, Graph Matrices, Control

Flow Testing: Statement Coverage, Branch Coverage, Condition Coverage, Path Coverage.

Course Outcomes: After completion of course, students would be able to:
1. apply software testing knowledge and testing methods.
2. design and conduct a software test process for a software testing project.
3. identify the needs of software test automation, and define and develop a test tool to support test automation.

Suggested Readings:

a) **Text Book:**
   1. Pressman R. S., 2009. Software Engineering: A Practitioner's Approach, 7th Edition, McGraw Hill Education.

b) **Reference Books:**
   1. Singh Y., 2011. Software Testing, Cambridge University Press.
   2. Dyer M., The Cleanroom approach to Quality Software Engineering, Wiley & Sons.
   3. Jalote P., An Integrated Approach to Software Engineering, Narosa Publications.

Skill Enhancement Courses
Syllabi of B.Sc. with Computer Science 6th Semester
(w.e.f. 2021-22)

20USECCS602
Android Programming

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

Note: *There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.*

Objectives:
1. Students will be able to understand concepts of Android Programming.
2. Learn to develop an App based on Android.

Unit-I

Introduction: History of Android, Introduction to Android Operating Systems, Android Development Tools, Android Architecture.

Unit-II

Overview of object oriented programming using Java: OOPs Concepts: Inheritance, Polymorphism, Interfaces, Abstract class, Threads, Overloading and Overriding, Java Virtual Machine.
User Interface Architecture: Application context, intents, Activity life cycle, multiple screen sizes.

Unit-III

Development Tools: Installing and using Eclipse with ADT plug-in, Installing Virtual machine for Android sandwich/Jelly bean (Emulator), configuring the installed tools, creating a android project – Hello Word, run on emulator, Deploy it on USB-connected Android device.

Unit-IV

User Interface Design: Form widgets, Text Fields, Layouts, Button control, toggle buttons, Spinners (Combo boxes), Images, Menu, and Dialog.
Database: Understanding of SQLite database, connecting with the database.

Course Outcomes: After completion of course, students would be able to:
1. Install and configure Android application development tools.
2. Design and develop user Interfaces for the Android platform.
3. Save state information across important operating system events.
4. Apply Java programming concepts to Android application development.

Suggested Readings:
a) **Text Books:**
1. Sheusi J. C., 2013. Android application development for Java Programmers, Cengage Learning.

2. Phillips B., Stewart C., Marsicano K. and Gardner B., 2019. Android Programming: The Big Nerd Ranch Guide, 4th Edition, Big Nerd Ranch Guides.

b) Reference Books:
1. Griffiths D., 2017. Head First Android Development: A Brain-Friendly Guide, 2nd Edition, O'Reilly Media.
2. Murach J., 2015. Murach's Android Programming, 2nd Edition, Mike Murach & Associates.

Skill Enhancement Courses
Syllabi of B.Sc. with Computer Science 6th Semester
(w.e.f. 2021-22)

20USECCS603
XML Programming

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

Note: There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.

Objectives:
1. Students will be able to learn the concepts of XML and its programming.
2. To learn about the web services and business system using XML.

Unit-I

XML Programming: Introduction, The Need for XML, Structured Data and Formatting, Advantages of XML, SGML, XML, and HTML, World Wide Web Consortium (W3C) Specifications and Grammars, XML Applications and Tools, Creating and Viewing XML Documents, Transforming XML Documents, XML Document Syntax, Validating XML Documents with DTDs, XML Namespaces.

Unit-II

Transforming XML Documents with XSLT and XPath, Formatting XML Documents with XSL-FO, Purpose of XSL Formatting Objects (XSL-FO), XSL-FO Documents and XSL-FO Processors, XSL-FO Namespace, Page Format Specifiers, Page Content Specifiers, Validating XML Documents with Schemas, Introduction to Simple Object Access Protocol (SOAP), SOAP's Use of XML and Schemas, Elements of a SOAP Message, Sending and Receiving SOAP Messages (SOAP Clients and Receivers), Handling SOAP Faults, Current SOAP Implementations.

Unit-III

Introduction to Web Services: Architecture and Advantages of Web Services, Purpose of Web Services Description Language (WSDL), WSDL Elements, Creating and Examining WSDL Files, Overview of Universal Description, Discovery, and Integration (UDDI), UDDI Registries (Public and Private), Core UDDI Elements, Deploying and Consuming Web Services, ebXML Specifications ebXML Registry and Repository, Introduction to the XML Document Object Model (XMLDOM)

Unit-IV

XML applications: B2B Scenarios, e-business system involved: delivery, sales, cross company communication: replacement for EDI, the document as the application, XML and relational databases, XML and dynamic Web publishing, benefits of XML schemas to applications, XML processors enforcing structure, application access to document structure, fixed values, channels.

Course Outcomes: After completion of course, students would be able to:
1. Learn the basics of creating XML documents.

2. Transform XML documents and validate XML documents.

3. Learn the basics and history of XML and how to write your own XML documents.

Suggested Readings:
   a) **Text Books:**
   1. Pardi W. J., 1999. XML in action Web Technology. Microsoft Press.
   2. Young M. J., 2002. Step by Step XML, Microsoft Press.
   b) **Reference Books:**
   1. Mcgrath M., 2012. XML in easy steps, 2nd Edition, McGraw Hill Education.
   2. Williamson H., 2001. XML: The Complete Reference. McGraw Hill Education.

Skill Enhancement Courses
Syllabi of B.Sc. with Computer Science 6th Semester
(w.e.f. 2021-22)

20USECCS604
R Programming

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

Note: There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.

Objectives:
1. Students will be able to understand the concept of R Programming.
2. To study Simulation and various Models in R.

Unit - I

Introduction to R: R Sessions and Functions, Basic Math, Variables, Data Types, Vectors, Conclusion, Advanced Data Structures, Strings, Data Frames, Lists, Matrices, Arrays, Classes, R Programming Structures, Control Statements, Loops, Looping Over Nonvector Sets- If-Else, Arithmetic and Boolean Operators and values, Default Values for Argument, Return Values, Functions are Objective, No Pointers in R, Recursion.

Unit - II

Doing Math and Simulation in R: Math Function, Extended Example Calculating Probability-Cumulative Sums and Products-Minima and Maxima-Calculus, Functions Fir Statistical Distribution, Sorting, Linear Algebra Operation on Vectors and Matrices, Set Operation, Input /output, Accessing the Keyboard and Monitor, Reading and writer Files.

Unit - III

Graphics: Creating Graphs, The Workhorse of R Base Graphics, the plot() Function Customizing Graphs, Saving Graphs to Files, Probability Distributions, Normal Distribution, Binomial Distribution, Poisson Distributions Other Distribution, Basic Statistics, Correlation and Covariance, T-Tests, ANOVA Test

Unit - IV

Linear Models: Simple Linear Regression, -Multiple Regression Generalized Linear Models, Logistic Regression, - Poisson Regression- other Generalized Linear Models-Survival Analysis, Nonlinear Models, Splines- Decision- Random Forests.

Course Outcomes: After completion of course, students would be able to:
1. Study the practical issues in statistical computing which includes programming in R.
2. Import data into R, accessing R packages, writing R functions, debugging, and organizing and commenting R code.
3. Learn statistical data analysis and optimization with working examples.

Suggested Readings:

a) **Text Books:**

1. Venables, W. N. and Ripley, B. D. (2002), Modern Applied Statistics with S, 4th ed., Springer-Verlag, New York.
2. Weisberg, S. (1985), Applied Linear Regression, 2nd ed., John Wiley & Sons, New York.

b) **Reference Books:**

1. Siegel, S. (1956), Nonparametric Statistics for the Behavioral Sciences, McGraw-Hill International, Auckland.
2. Venables, W. N. and Ripley, B. D. (2000), S Programming, Springer-Verlag, New York.
3. Zar, J. H. (1999), Biostatistical Analysis, Prentice Hall, Englewood Cliffs, NJ.