Proposed Syllabus

For

BCA(Honours)Submitted

To

University of Gour Banga

Under

Choice Based Credit System (CBCS)

[With effect from the Session 2019- 20]

Academic Semesters	Courses					Credits	Marks
	Discipline Core (DC)	Discipline Specific Elective (DSE)	Generic Elective (GE)	Ability Enhancement Compulsory (AEC)	Skill Enhancement (SEC)		
SEM-I	**DC1:**Mathematics **DC2:a)**Introduction to Programming through C **b)**C Programming Lab	--	GE-1:	ENVS	--	20	200
SEM-II	**DC3: a)** Data Structure & Algorithm **b)** Data Structure Lab **DC4:**Digital Logic System	--	GE-2:	Communicative English/ Communicative Bengali/ Modern Indian Language	--	20	200
SEM-III	**DC5:**Computer Organization & Architecture **DC6: a)**Operating System **b)**Operating System Lab **DC7:a)**Object Oriented Programming with C++ **b)**Object Oriented Programming with C++ Lab	--	GE-3:	--	--	24	200
SEM-IV	**DC8:** Discrete Mathematics **DC9:a)**Database Management System **b)**Database Management System lab using MySQL **DC10:a)**Introduction to Arduino sensors **b)** Arduino sensors Lab	--	GE-4:	--	--	24	200
SEM-V	**DC11:**Data Communication & Networking **DC12:a)**Computer Graphics **b)**Computer Graphics lab using OpenGL	**DSE1:** **E1:(a)** Introduction to Java Programming **(b)**Java Programming lab **E2: (a)** Introduction to Python Programming **(b)** Python Programming Lab	--	--	**SEC-1:** Sensor Network & IOT	26	250

		DSE2: **E1:**Operation Research **E2:**Intelligent System **E3:**Cloud Computing **E4:**Theory of Computation					
SEM-VI	**DC13:** Software Engineering **DC14 :**Web Design	**DSE-3:E1:**Digital Image Processing **E2:**Introduction to Data Science **E3:**Soft Computing **DSE-4:**Project	--	--	**SEC-2:** Introduction to PHP	26	250
Total	--	--	--	--	--	140	1300

SEM-I

DC1: Mathematics: 60 hours

Matrices: Review of fundamentals: Definition of matrix, order, Types of matrices: zero, row, column, square, diagonal, scalar, unit, symmetric, skew-symmetric. Determinant: Value of determinant of order 2x2, 3x3, minors, cofactors, adjoint, inverse of a matrix. Solutions of linear equations: Cramers rule and matrix method involving two and three variables. Eigen values and Eigenvectors: Characteristic equation, characteristic roots, characteristic vectors (without any theorems) only 2x2 order.

Logarithms: Definition of Logarithm, Indices leading to Logarithms and vice versa, Laws of Logarithms with proofs, and related Problems.

Permutation and Combination: Fundamental Principle of Counting, Factorial n, Permutations: Definition, Examples, Derivation of Formula nPr, Permutation when all the objects are not distinct, Problems, Combinations: Definition, examples, Proving nCr = nPr r!, nCr = nCn-r, nCr + nCr-1 = n+1Cr, Problems based on above formulae.

Statistics : Definition of Statistics, Raw data, Classification of data, Average, Scatter, range, Relationship between Mean, Median, Mode, Dispersion, Mean Deviation, Standard Deviation, Variance.

Probability: Meaning of Probability, Random Experiment and outcome, Sample Space, Sample Point, Type of Sample Space, Type of Events, and Probability of an Event, Total and Conditional Probability, Probability distribution of a random Variable, Repeated independent (Bernouli) trials and Binomial distribution.

Vectors: Definition of vector and scalar, vector addition, dot and cross product, projection of a vector on the other (no geometrical meaning), area of parallelogram, area of a triangle.

Analytical Geometry in Two Dimensions: Coordinates, Distance formula, Section Formula, Area of the Triangle formula (no derivation), Locus of point. Straight Line: Slope of a line and angle between two lines, Various forms of equations of lines – Derivation and Problems. Equation of family of lines passing through the point of intersection of two lines, Distance of a point from line (only problems).

Basic concepts on Circle, Parabola, Ellipse and its related problems.

Text/ Reference Books:

1. Mathematical Foundations, P.R.Vittal, Margham Publication.
2. Mathematical Foundation, U. Rizwan, SciTech.
3. Dircrete Mathematical Foundation, V.Sundaram & Others, A.P.Publication.
4. Analytical Geometry 2 Dimension, P.Duraipandian & Others, Emerald publication.
5. Analytical Geometry part I - Two Dimension, Manicavachagom pillay & Natarajan. S. Viswanathan (printers & publication) Pvt Ltd.
6. Advanced Mathematics, Heena Timani, Books India.
7. Theory and Problems in Mathematics, BOSCO Publications.
8. Engineering Mathematics, Volumes I–IV, S Chandrashekar.
9. Basic Probability Theory, R. B. Ash, Dover Publications.

10. A Text book of Engineering Mathematics, H. S. Gangwar, P. Gupta, New Age International Pub.

DC2: a) Introduction to Programming through C: 60 hours

Introduction: Basic Structure, Algorithms, Flowcharts, Structured programming constructs.

C Programming elements: Character sets, Keywords, Constants, Variables, Data Types, Operators-Arithmetic, Relational, Logical and Assignment; Increment and Decrement and Conditional Operator, Precedence and Associations; Expressions, type casting. Comments, Functions, Storage Classes, Bit manipulation, Input and output.

C Pre-processor: File inclusion, Macro substitution.

Statements: Assignment, Control statements- if, if else, switch, break, continue, goto, Loops-while, do_while, for.

Functions: Argument passing, return statement, return values and their types, recursion

Arrays: String handling with arrays, String handling functions.1D Arrays, 2D Arrays.

Pointers: Definition and initialization, Pointer arithmetic, Pointers and arrays, String functions and manipulation, Dynamic storage allocation.

User defined Data types: Structures. Structure arrays, Pointers to Functions and Structures, Unions

File Access: Opening, Closing, I/O operations.

DC2: b) C Programming Lab: 40 hours

Some sample examples are given below. More problems can be included related to the theory. Use open source C compiler (GCC).

1. WAP to print the sum and product of digits of an integer.

2. WAP to reverse a number.

3. WAP to compute the sum of the first n terms of the following series, S=1+1/2+1/3+1/4+……

4. WAP to compute the sum of the first n terms of the following series, S =1-2+3-4+5……………

5. Write a function that checks whether a given string is Palindrome or not. Use this function to find whether the string entered by user is Palindrome or not.

6.Write a function to find whether a given no. is prime or not. Use the same to generate the prime numbers less than 100.

7. WAP to compute the factors of a given number.

8. Write a macro that swaps two numbers. WAP to use it.

9.WAP to print a triangle of stars as follows (take number of lines from user):

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

10.WAP to perform following actions on an array entered by the user :

i) Print the even-valued elements

ii) Print the odd-valued elements

iii) Calculate and print the sum and average of the elements of array

iv) Print the maximum and minimum element of array

v) Remove the duplicates from the array

vi) Print the array in reverse order

The program should present a menu to the user and ask for one of the options. The menu should also include options to re-enter array and to quit the program.

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

12. Write a program that swaps two numbers using pointers.

13. Write a program in which a function is passed address of two variables and then alter its contents.

14. Write a program which takes the radius of a circle as input from the user, passes it to another function that computes the area and the circumference of the circle and displays the value of area and circumference from the main() function.

15. Write a program to find sum of n elements entered by the user. To write this program, allocate memory dynamically using malloc() / calloc() functions or new operator.

16. Write a menu driven program to perform following operations on strings:

a) Show address of each character in string

b) Concatenate two strings without using strcat function.

c) Concatenate two strings using strcat function.

d) Compare two strings

e) Calculate length of the string (use pointers)

f) Convert all lowercase characters to uppercase

g) Convert all uppercase characters to lowercase

h) Calculate number of vowels

i) Reverse the string

17. Given two ordered arrays of integers, write a program to merge the two-arrays to get an ordered array.

18. WAP to display Fibonacci series (i)using recursion, (ii) using iteration.

19. WAP to calculate Factorial of a number (i)using recursion, (ii) using iteration.

20. WAP to calculate GCD of two numbers (i) with recursion (ii) without recursion.

21. Create Matrix class using templates. Write a menu-driven program to perform following

Matrix operations (2-D array implementation):

a) Sum b) Difference c) Product d) Transpose

22. Copy the contents of one text file to another file, after removing all whitespaces.

23. Write a function that reverses the elements of an array in place. The function must accept only one pointer value and return void.

24. Write a program that will read 10 integers from user and store them in an array.

Implement array using pointers. The program will print the array elements in ascending and descending order.

Text/ Reference Books:

1. Programming with C, Byron S. Gottfried, McGraw Hill.

2. The C Programming Language, Kernighan and Dennis, PHI.

3. The Complete reference C, Herbert Schildt, McGraw Hill.

4. Let Us C, Kanitkar, BPB Publication.

5. Programming in ANSI C, Balaguruswamy, McGraw Hill.

6. Programming Languages, Allen B. Tucker, Tata McGraw Hill.

SEM-II

DC3: a) Data Structure & Algorithm: 60 hours

Introduction to Data Structure: Abstract Data Type.

Arrays: 1D, 2D and Multi-dimensional Arrays, Sparse Matrices. Polynomial representation (Polynomial Representation as Application).

Linked Lists: Singly, Doubly and Circular Lists; Polynomial representation (Polynomial Representation as Application).

Stacks: Implementing single / multiple stacks in an Array; Prefix, Infix and Postfix expressions, Utility and conversion of these expressions from one to another; Applications of stack; Limitations of Array representation of stack.

Queues: Array and Linked representation of Queue, Circular Queue, De-queue, Priority Queues.

Recursion: Developing Recursive Definition of Simple Problems and their implementation; Advantages and Limitations of Recursion; Understanding what goes behind Recursion (Internal Stack Implementation).

Trees: Introduction to Tree as a data structure; Binary Trees (Insertion, Deletion, Recursive and Iterative Traversals on Binary Search Trees; Height-Balanced Trees (Various operations on AVL Trees).

Searching and Sorting: Linear Search, Binary Search, Comparison of Linear and Binary Search, Sort: Bubble sort, Selection Sort, Insertion Sort, Merge Sort, Quick sort, Heap Sort, Comparison of Sorting Techniques.

Hashing: Introduction to Hashing, Choosing a Hash Function, collision resolution techniques.

DC3: b) Data Structure Lab: 40 hours

Some sample examples are given below. More problems can be included related to the theory. Use open source C compiler (GCC).

1. Write a program to search an element from a list. Give user the option to perform Linear or Binary search.

2. WAP using templates to sort a list of elements. Give user the option to perform sorting using Insertion sort, Bubble sort, Selection sort etc.

3. Implement Singly Linked List. Include functions for insertion, deletion and search of a number, reverse the list and concatenate two linked lists.

4. Implement Doubly Linked List using templates. Include functions for insertion, deletion and search of a number, reverse the list.

5. Implement Circular Linked List. Include functions for insertion, deletion and search of a number, reverse the list.

6. Perform Stack operations using Linked List implementation.

7. Perform Stack operations using Array implementation.

8. Perform Queues operations using Circular Array implementation.

9. Create and perform different operations on Double-ended Queues using Linked List implementation.

10. WAP to scan a polynomial using linked list and add two polynomials.

11. WAP to calculate factorial and to compute the factors of a given no. (i)using recursion, (ii) using iteration

12. WAP to display Fibonacci series (i)using recursion, (ii) using iteration.

13. WAP to calculate GCD of 2 number (i) with recursion (ii) without recursion.

14. WAP to create a Binary Search Tree and include following operations in tree:

(a) Insertion (Recursive and Iterative Implementation)

(b) Deletion by copying

(c) Deletion by Merging

(d) Search a no. in BST

(e) Display its preorder, postorder and inorder traversals Recursively

(f) Display its preorder, postorder and inorder traversals Iteratively

(g) Display its level-by-level traversals

(h) Count the non-leaf nodes and leaf nodes

(i) Display height of tree

(j) Create a mirror image of tree

(k) Check whether two BSTs are equal or not

15. WAP to reverse the order of the elements in the stack using additional stack.

Text/ Reference Books:

1. Fundamentals of Data Structures in C, Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Silicon Pr.

2. Data Structures: A Pseudocode Approach with C, Richard F. Gilberg and Behrouz A.Forouzan, Cengage Learning

3. Data Structures In C, Noel Kalicharan, CreateSpace Independent Publishing Platform.

4. Data Structures and algorithm in C, Adam Drozdek, Cengage Learning.

5. The C Programming Language, Brian W. Kernighan and Dennis Ritchie, Prentice Hall.

6. Data Structures, Algorithms and applications in C++, Sartaj Sahni,Universities Press.

7. Data StructuresUsing C and C++, Aaron M. Tanenbaum, Moshe J. Augenstein, Yedidyah Langsam, PHI.

8. Classic Data Structures, Debasis Samanta, PHI

9. Fundamental of Computer Algorithms, Horowitz, Sahni, Rajasekaran, Universities Press.

DC4: a) Digital Logic System: 60 hours

Boolean Algebra: Fundamentals of Boolean Expression: Definition of Switching Algebra, Basic properties of Switching Algebra, Huntington's Postulates, Basic logic gates (AND, OR, NOT), De-Morgan's Theorem, Universal Logic gates (NAND, NOR), Minterm, Maxterm, Minimization of Boolean Functions using K-Map, Simplification of logic expression.

Combinational Circuits: Half adders, Full Adder, Half Subtractor, Full Subtractor and construction using Basic Logic Gates (OR, AND, NOT) and Universal Logic Gates (NAND & NOR), Multibit Adder- Ripple Carry Adder, Carry Look Ahead adder, BCD Adder, Adder/Subtractor unit Construction using 4 bit Full adders units, 1 bit, 2 bit and 3bit Comparators.

Data Selector-Multiplexer: Expansion (Cascading), Function Realization.

Encoders: Realization of simple Encoders and priority Encoders using Basic and Universal Logic gates. Data Distributor: De-multiplexer, Cascading. Chip Selector/Minterm Generator - Decoder-Function Realization, Cascading, Parity bit Generator/Checker, Gray to Binary code converter, Binary to Gray Code Converter.

Sequential Circuits: Set/Reset (SR) Latch: Using NAND and NOR gates, D Latch, J-K Latch, T Flip Flop, Race around Condition, Master Slave J-K Flip Flop, Edge Triggered SR, D and JK Flip Flop, Flip-Flop Conversions.

Registers: Serial Input Serial Output, Serial Input Parallel Output, Parallel input Serial Output, Parallel Input parallel Output, Universal Shift Registers.

Counters: Asynchronous Counter: UP/DOWN Counters, Mod - N Counters, BCD Counter, Synchronous Counter: UP/DOWN Counters, Mod-N Counters.

Text/Reference Books:

1. Digital Circuits, Vol - I & II, D. Ray Chaudhuri, Platinum Publishers.
2. Digital Systems - Principle & Applications, Tocci & Widmer, EEE.
3. Digital Logic & State Machine Design, Comer, Oxford.
4. Digital Principle & Applications, Malvino & Leach, McGraw Hill.
5. Digital Design, Mano, PHI.
6. Digital Integrated Electronics- H.Taub & D.Shilling, McGraw Hill.
7. Digital Circuits and Design, Salivahan, Vikas

SEM-III

DC5: Computer Organization & Architecture: 60 hours

Basic Structure of Computers: Basic Functional Units, Basic Operational Concept, Bus Structure, Software, Performance, Multiprocessor and Multicomputer.

Register Transfer and Micro-operation: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Three State Bus Buffers, memory Transfer, Arithmetic and Logical micro-operations, Shift and Arithmetic shifts.

Basic Computer Organization and Design: Instruction Codes, Stored Program Organization, Indirect Address, Computer Registers, Common Bus System, Computer Instruction, Timing and Control, Instruction Cycle, Input-Output and Interrupt.

CPU Organization: Arithmetic and Logic Unit (ALU)- Combinational ALU, 2'S Complement Addition, Subtraction Unit, Booths Algorithm for Multiplication, Division Algorithm. General register organization, Accumulator Based, Register Based, Stack Type CPU organization.

Control Unit: Hardwired Control Unit, Micro-programmed Control Unit.

CPU Registers: Program Counter, Stack Pointer Register, Memory Address Register, Instruction Register, Memory Buffer Register, Flag registers, Temporary Registers.

Instructions: Operational Code, Operands, Zero, One, Two and Three Address Instruction, Instruction Types, Addressing modes, Data Transfer and Manipulation instructions, Program control instructions.

CISC and RISC processors: Introduction, relative merits and De-merits.

Input / Output Organization: Polling, Interrupts, subroutines, Memory mapped IO, IO mapped IO, DMA, Bus Arbitration.

Memory: Primary memory: ROM, PROM, EPROM, EEPROM, Flash memory, RAM: SRAM, DRAM, Cache Memory: Mapping Functions, Replacement Algorithms, Hit and Miss ratio, Virtual memories, Address Translation, Memory Management requirements, Secondary Storage.

Introduction to Microcomputer based system: Concepts of Microprocessor and Microcontrollers and their advantages and disadvantages.

Microprocessor Architecture: Basic Architecture of Microprocessor 8085 and explanation of each block, Microprocessor 8085 pin out and signals, Addressing modes, Instruction Formats, Instruction Cycle, Multiplexed Address Data Bus, Control and Status signals, De-multiplexing of Address Data Bus.

Programming 8085: Instruction Set of 8085, Different Programming Techniques, Stack and Subroutines.

Text/Reference Books:

1. Computer System Architecture, Morries Mano, Pearson.
2. Computer Organization & Architecture, Williams Stallings, Pearson.
3. Computer Organization, Hamacher, Vranesic and Zaky, McGraw Hill.
4. Computer Architecture and Organization, Govindrajalu, Tata McGraw Hill.
5. Computer Architecture and Organization, J P Hayes, Tata McGRaw Hill.
6. Structured Computer Organization, Andrew S. Tanenbaum, Austin, Pearson.
7. Microprocessor architecture, programming and applications with 8085/8085A, Wiley eastern Ltd, by Ramesh S. Gaonkar.
8. Intel Corp: The 8085 / 8085A. Microprocessor Book – Intel marketing communication, Wiley inter science publications.

DC6: a) Operating System: 60 hours

Introduction Basic OS functions, types of operating systems: batch systems–multiprogramming systems, time sharing systems;

Operating System Organization: Processor and user modes, kernels, system calls and system programs.

Process System view of the process and resources, process hierarchy, threads, threading issues.

Process Scheduling: Scheduling criteria, Pre-emptive and non-preemptive scheduling, Long term, short term and medium term, FCFS, SJF, SRTF, Priority scheduling, Round Robin, Multilevel Queue Scheduling, Multilevel Queue Feedback Scheduling.

Process Synchronization: Concurrent Processes, critical section, semaphores and application, methods for inter-process communication;

Deadlock: Definition, Prevention, Avoidance, Detection, Recovery, Banker's algorithm.

Memory Management: Physical and virtual address space; memory allocation strategies –fixed and variable partitions, paging, segmentation, virtual memory

File and I/O Management: Directory structure, file operations, file allocation methods, disc management.

Case study: UNIX Operating System.

DC6: b) Operating System Lab: 40 hours

Some sample examples/Commands are given below. More problems can be included related to the theory. Use open source system (Debian OS).

1. Usage of following commands: ls, pwd, tty, cat, who, who am I, rm, mkdir, rmdir, touch, cd.
2. Usage of following commands: cal, cat(append), cat(concatenate), mv, cp, man, date.
3. Usage of following 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.
19. Write a shell script to check whether the file have all the permissions or not.
20. Program to show the pyramid of special character "*".

Text/ Reference Books:

1. Operating Systems Concepts, A Silberschatz, P.B. Galvin, G. Gagne, John Wiley Publications
2. Modern Operating Systems, A.S. Tanenbaum, Pearson Education
3. Operating Systems: A Modern Perspective, G. Nutt, Pearson Education.
4. Operating Systems, Internals & Design Principles W.Stallings, PHI.
5. Operating Systems- Concepts and design, M. Milenkovic, Tata McGraw Hill.
6. UNIX Concepts and Applications, Sumitabha Das, Tata McGraw-Hill.
7. Understanding the Linux Kernel, D. P. Bovet and M. Cesati, O'Reilly.

DC7: a) Object Oriented Programming with C++: 60 hours

Introduction to C++: Overview of Procedural Programming and Object-Orientation Programming, Concepts of Data Types, Variables, Constants, Operators and Basic I/O Expressions, Conditional Statements and Iterative Statements, Functions and Arrays, Pointers and References in C++, Memory Allocation in C++.

Using Classes in C++: Principles of Object-Oriented Programming, Defining & Using Classes, Class Constructors, Constructor Overloading, Function overloading in classes, Class Variables &Functions, Objects as parameters, specifying the Protected and Private Access, Copy Constructors, Overview of Template classes and their use.

Overview of Function Overloading and Operator Overloading: Need of Overloading functions and operators, Overloading functions by number and type of arguments, Looking at an operator as a function call, Overloading Operators (including assignment operators, unary operators)

Inheritance, Polymorphism and Exception Handling: Introduction to Inheritance (Multi-Level Inheritance, Multiple Inheritance), Polymorphism (Virtual Functions, Pure Virtual Functions), Abstract class, Basics Exceptional Handling (using catch and throw, multiple catch statements), Catching all exceptions, Restricting exceptions.

DC7: b) Object Oriented Programming with C++ Lab: 40 hours

Some sample examples are given below. More problems can be included related to the theory. Use open source C++ compiler (GNU C++).

1. WAP to print the sum and product of digits of an integer.

2. WAP to reverse a number.

3. WAP to compute the sum of the first n terms of the following series S = 1+1/2+1/3+1/4+……

4. WAP to compute the sum of the first n terms of the following series S =1-2+3-4+5……………

5. Write a function that checks whether a given string is Palindrome or not. Use this function to find whether the string entered by user is Palindrome or not.

6. Write a function to find whether a given no. is prime or not. Use the same to generate the prime numbers less than 100.

7. WAP to compute the factors of a given number.

8. Write a macro that swaps two numbers. WAP to use it.

9. WAP to print a triangle of stars as follows (take number of lines from user):

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

10. WAP to perform following actions on an array entered by the user:

i.Print the even-valued elements

ii.Print the odd-valued elements

iii.Calculate and print the sum and average of the elements of array

iv.Print the maximum and minimum element of array

v.Remove the duplicates from the array

vi.Print the array in reverse order

The program should present a menu to the user and ask for one of the options. The menu should also include options to re-enter array and to quit the program.

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

12. Write a program that swaps two numbers using pointers.

13. Write a program in which a function is passed address of two variables and then alter its contents.

14. Write a program which takes the radius of a circle as input from the user, passes it to another function that computes the area and the circumference of the circle and displays the value of area and circumference from the main() function.

15. Write a program to find sum of n elements entered by the user. To write this program, allocate

memory dynamically using new operator.

16. Write a menu driven program to perform following operations on strings:

a) Show address of each character in string

b) Concatenate two strings without using strcat function.

c) Concatenate two strings using strcat function.

d) Compare two strings

e) Calculate length of the string (use pointers)

f) Convert all lowercase characters to uppercase

g) Convert all uppercase characters to lowercase

h) Calculate number of vowels

i) Reverse the string

17. Given two ordered arrays of integers, write a program to merge the two-arrays to get an ordered array.

18. WAP to display Fibonacci series (i)using recursion, (ii) using iteration

19. WAP to calculate Factorial of a number (i)using recursion, (ii) using iteration

20. WAP to calculate GCD of two numbers (i) with recursion (ii) without recursion.

21. Create Matrix class using templates. Write a menu-driven program to perform following Matrix operations (2-D array implementation):

a) Sum b) Difference c) Product d) Transpose

22. Create the Person class. Create some objects of this class (by taking information from the user). Inherit the class Person to create two classes Teacher and Student class. Maintain the respective information in the classes and create, display and delete objects of these two classes (Use Runtime Polymorphism).

23. Create a class Triangle. Include overloaded functions for calculating area. Overload assignment operator and equality operator.

24. Create a class Box containing length, breath and height. Include following methods in it:

a) Calculate surface Area

b) Calculate Volume

c) Increment, Overload ++ operator (both prefix & postfix)

d) Decrement, Overload -- operator (both prefix & postfix)

e) Overload operator == (to check equality of two boxes), as a friend function

f) Overload Assignment operator

g) Check if it is a Cube or cuboid

Write a program which takes input from the user for length, breath and height to test the above class.

25. Create a structure Student containing fields for Roll No., Name, Class, Year and Total Marks. Create 10 students and store them in a file.

26. Write a program to retrieve the student information from file created in previous question and print it in following format:

Roll No. Name Marks

27. Copy the contents of one text file to another file, after removing all whitespaces.

28. Write a function that reverses the elements of an array in place. The function must accept only one pointer value and return void.

29. Write a program that will read 10 integers from user and store them in an array. Implement array using pointers. The program will print the array elements in ascending and descending order.

Text/ Reference Books:

1. C++: The Complete Reference, Herbtz Schildt,McGraw Hill.
2. The C++ Programming Language, Bjarne Stroustrup, Addison-Wesley.
3. Programming -- Principles and Practice using C++,Bjarne Stroustroup, Addison-Wesley.
4. Object Oriented Programming with C++, E Balaguruswamy, Tata McGraw-Hill Education.
5. C++ How to Program, Paul Deitel, Harvey Deitel, Prentice Hall.
6. Programming with C++, John R. Hubbard,Schaum's Series.
7. Accelerated C++, Andrew Koeni, Barbara, E. Moo, Published by Addison-Wesley.
8. Effective C++, Scott Meyers, Published by Addison-Wesley.
9. Head First C++ Programming: The Definitive Beginner's Guide, Harry, H. Chaudhary, First Create space Inc, O-D Publishing, LLC USA.
10. Problem Solving with C++,Walter Savitch, Pearson Education.
11. C++ Primer, Stanley B. Lippman, JoseeLajoie, Barbara E. Moo, Published by Addison-Wesley.

SEM-IV

DC8: Discrete Mathematics: 60 hours

Sets: finite and Infinite sets, un-countably Infinite Set; functions, relations, Properties of Binary Relations, Closure, Partial Ordering Relations; counting - Pigeonhole Principle, Permutation and Combination; Mathematical Induction, Principle of Inclusion and Exclusion.

Recurrences: Recurrence Relations, generating functions, Linear Recurrence Relations with constant coefficients and their solution, Substitution Method, Master Theorem, Growth of Functions: Asymptotic Notations.

Graph Theory : Basic Terminology, Models and Types, multi-graphs and weighted graphs, Graph Representation, Graph Isomorphism, Connectivity, Euler and Hamiltonian Paths and Circuits, Trees, Basic Terminology and properties of Trees, Binary tree, Introduction to Spanning Tree. Problems related to Minimum Spanning Tree (MST), all pair shortest path, graph traversals etc.. Matrix representation: Adjacency matrix, Incident matrix.

Prepositional Logic Logical Connectives, Well-formed Formulas, Tautologies, Equivalences, Inference Theory.

Text/ Reference Books:

1. Elements of Discrete mathematics, C.L. Liu , D.P. Mahopatra, Tata McGraw Hill
2. Discrete Mathematics and Its Applications, Kenneth Rosen, McGraw Hill
3. Introduction to algorithms ,T.H. Coremen, C.E. Leiserson, R. L. Rivest, Prentice Hall on India,
4. Discrete Mathematics with Algorithms, M. O. Albertson and J. P. Hutchinson, John wiley Publication,
5. Discrete Structures, Logic, and Computability, J. L. Hein, , Jones and Bartlett Publishers,
6. Essentials of Discrete Mathematics, D.J. Hunter, Jones and Bartlett Publishers
7. Discrete Mathematical Structures with Applications to Combinatorics, V Ramaswamy, University Press
8. Discrete Mathematics: A Concept-based Approach, Basavaraj S Anami, Venkanna S Madalli, University Press
9. Graph Theory with Applications to Engineering and Computer Science, N. Deo, PHI.
10. Introduction to Graph Theory, D. B. West, Pearson.

DC9: a) Database Management System: 60 hours

Introduction: Drawbacks of file System; Advantages of DBMS; Layered Architecture of Database, Data Independence; Data Models; Schemas And Instances; Database Languages; Database Users, DBA; Data Dictionary; Functional Components of a DBMS.

Entity Relationship(ER) Modelling: Entity, Attributes and Relationship, Structural Constraints, Keys, ER Diagram of Some Example Database, Weak Entity Set, Specialization and Generalization, Constraints of Specialization and Generalization, Aggregation.

Relational Model: Basic Concepts of Relational Model; Relational Algebra.

Integrity Constraints: Domain Constraints, Referential Integrity, Assertions, Triggers.

Relational Database Design: Problems of Un-Normalized Database; Functional Dependencies (FD), Derivation Rules, Closure of FD Set, Membership of A Dependency, Canonical Cover; Decomposition to1NF, 2NF, 3NF and BCNF Using FD; Lossless Join Decomposition; Dependency preservation.

SQL: Basic Structure, Data Definition, Constraints and Schema Changes; Basic SQL Queries (Selection, Insertion, Deletion, Update); Order by Clause; Complex Queries, Aggregate Function and Group by Clause; Nested Sub Queries; Correlated Sub Queries; Views (Insert-Able and Updatable), Joined Relations; Set Comparisons (All, Some).

Record Storage and File Organization (Concepts only): Fixed Length and Variable Length Records; Spanned and Un-Spanned Organization of Records; Primary File Organizations and Access Structures Concepts; Unordered, Sequential, Hashed; Concepts of Primary and Secondary Index; Dense and Sparse Index; Index Sequential Files; Multilevel Indices.

Transaction Processing (Concepts only): ACID Properties; Transaction States, Concurrent Execution; Serializability (Conflict and View), Recoverability, Test for Serializability.

DC9: b) Database Management System lab using MySQL: 40 hours

RDBMS Lab using MySQL

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Some sample examples are given below. More problems can be included related to the theory. Use open source system.

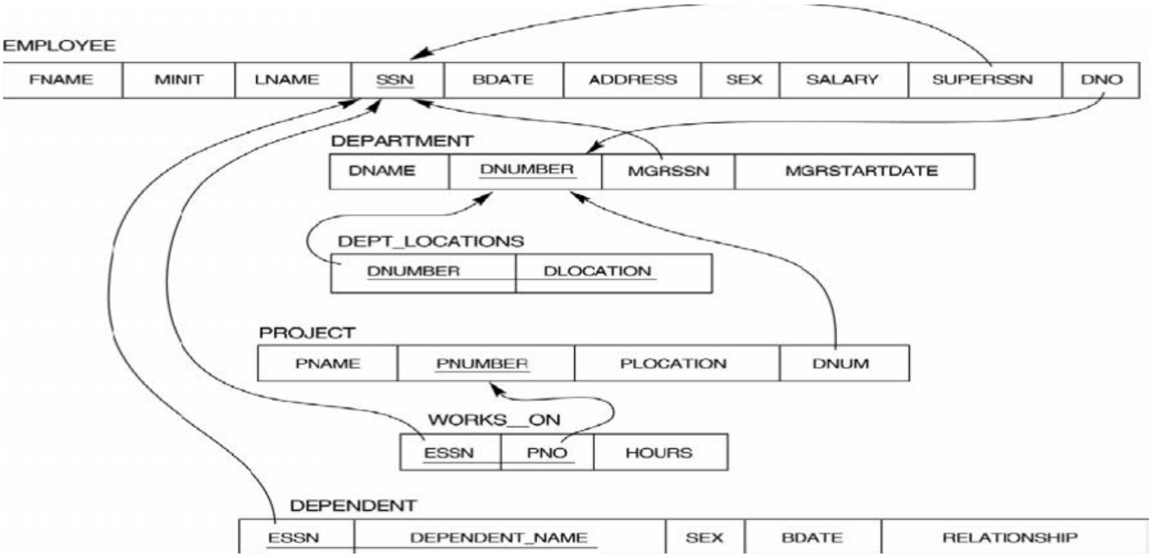
DDL Commands

• Create table, alter table, drop table.

DML Commands

• Select , update, delete, insert statements
• Condition specification using Boolean and comparison operators (and, or, not,=,<>,>,<,>=,<=)
• Arithmetic operators and aggregate functions(COUNT, SUM, AVG, MIN, MAX)
• Multiple table queries (join on different and same tables)
• Nested select statements
• Set manipulation using (any, in, contains, all, not in, not contains, exists, not exists, union, intersect, minus, etc.)
• Categorization using group by, having
• Arranging using order by

Relational Database Schema - COMPANY



Questions to be performed on above schema

A. Create tables with relevant foreign key constraints and other constraints. Populate the tables with data.

Perform the following queries on the database :

1. Display all the details of all employees working in the company.
2. Display ssn, lname, fname, address of employees who work in department no 7.
3. Retrieve the birthdate and address of the employee whose name is 'Franklin T. Wong'
4. Retrieve the name and salary of every employee
5. Retrieve all distinct salary values
6. Retrieve all employee names whose address is in ‘Bellaire’
7. Retrieve all employees who were born during the 1950s
8. Retrieve all employees in department 5 whose salary is between 50,000 and 60,000(inclusive)
9. Retrieve the names of all employees who do not have supervisors
10. Retrieve SSN and department name for all employees
11. Retrieve the name and address of all employees who work for the 'Research' department
12. For every project located in 'Stafford', list the project number, the controlling department number, and the department manager's last name, address, and birthdate.
13. For each employee, retrieve the employee's name, and the name of his or her immediate supervisor.
14. Retrieve all combinations of Employee Name and Department Name

15. Make a list of all project numbers for projects that involve an employee whose last name is 'Narayan' either as a worker or as a manager of the department that controls the project.

16. Increase the salary of all employees working on the 'ProductX' project by 15%. Retrieve employee name and increased salary of these employees.

17. Retrieve a list of employees and the project name each works in, ordered by the employee's department, and within each department ordered alphabetically by employee first name.

18. Select the names of employees whose salary does not match with salary of any employee in department 10.

19. Retrieve the name of each employee who has a dependent with the same first name and same sex as the employee.

20. Retrieve the employee numbers of all employees who work on project located in Bellaire, Houston, or Stafford.

21. Find the sum of the salaries of all employees, the maximum salary, the minimum salary, and the average salary. Display with proper headings.

22. Find the sum of the salaries and number of employees of all employees of the 'Marketing' department, as well as the maximum salary, the minimum salary, and the average salary in this department.

23. Select the names of employees whose salary is greater than the average salary of all employees in department 10.

24. For each department, retrieve the department number, the number of employees in the department, and their average salary.

25. For each project, retrieve the project number, the project name, and the number of employees who work on that project.

26. Change the location and controlling department number for all projects having more than 5 employees to 'Bellaire' and 6 respectively.

27. For each department having more than 10 employees, retrieve the department no, no of employees drawing more than 40,000 as salary.

28. Insert a record in Project table which violates referential integrity constraint with respect to Department number. Now remove the violation by making necessary insertion in the Department table.

29. Delete all dependents of employee whose ssn is '123456789'.

30. Delete an employee from Employee table with ssn = '12345'(make sure that this employee has some dependents, is working on some project, is a manager of some department and is supervising some employees). Check and display the cascading effect on Dependent and Works on table. In Department table MGRSSN should be set to default value and in Employee table SUPERSSN should be set to NULL

31. Perform a query using alter command to drop/add field and a constraint in Employee table.

Text/ Reference Books:

1. Fundamentals of Database Systems 6th Edition, R. Elmasri, S.B. Navathe, PearsonEducation.

2. Database Management Systems, R. Ramakrishanan, J. Gehrke,3rd Edition, McGraw-Hill.

3. Database System Concepts 6th Edition, A. Silberschatz, H.F. Korth, S. Sudarshan, McGraw Hill.

4. Database Systems Models, Languages, Design and application Programming, R. Elmasri, S.B. Navathe, Pearson Education.

5. SQL and Relational Theory: How to Write Accurate SQL Code, Christopher J. Date, O'Reilly Media

6. Database Systems: A Practical Approach to Design, Implementation and Management, Thomas M. Connolly and Carolyn E. Begg, Pearson

7. My SQL Administrator's Bible, S. Cabral, K. Murphy, Wiley.

DC10: a) Introduction to Arduino Sensors: 60 hours

Introduction: Arduino Basics, The Arduino UNO platform, Block Diagram, Architecture.

Arduino Basic programming essentials: Arduino Control structure, Arduino Functions, Arduino operators, Arduino Sketch Structure.

Interfacing: LED with Arduino, Working of LED, Sketch for blinking LED using delay function, Sketch Explanation, Interfacing LCD display with Arduino, Interfacing different sensors with Arduino Sensor.

IR Sensor: Introduction to IR Sensor, Working of IR sensor, Pinouts of IR sensor, Connection of IR sensor with Arduino, Sketch showing working of IR sensor, Sketch explanation Sensor.

Interfacing with Sensors: Introduction to HC-SR04, Working of HC-SR04, Pinouts of HC-SR04, Connection of HC-SR04 with Arduino. Interfacing with Humidity sensor (DHT22), Temperature sensor (LM35), PIR SENSOR, GPS.

DC10: b) Arduino UNO Lab: 40 hours

Some sample examples are given below. More problems can be included related to the theory. Use Arduino UNO board to implement.

1. To build a sensor circuit that senses ambient light level and uses its sensor reading to make a decision (Analogue to Digital Conversion ADC).
2. To use Pulse-Width Modulation (PWM) to fade in and out an LED (Digital to Analogue Conversion DAC).
3. Interfacing with PIR sensor.
4. Interfacing with Ultra sonic sensor.

Text/Reference books:

1. Make: Sensors, Book by Kimmo Karvinen, Tero Karvinen, and Ville Valtokari.
2. Getting Started with Sensors: Measure the World with Electronics, Arduino and Raspberry Pi by Kimmo Karvinen and Tero Karvinen
3. Arduino Programming in 24 Hours, Sams Teach Yourself, Pearson

SEM-V

DC11: Data Communication &Networking: 60 hours

Data Communication Concepts: Analog and Digital Signals, Periodic and Non-periodic signals, Time and Frequency Domain, Bandwidth and Data rate, Signal rate, Serial and Parallel Transmission. Protocol.

Various modes of transmission: Simplex/ Half Duplex, Duplex; Features of guided and unguided transmission media; Circuit Switching, Packet Switching; transmission impairment.

Physical structure of Network: Types of connections (Topologies), Categories of Computer Network: LAN, MAN, WAN; Digital to Digital conversion: line coding schemes;Analog to Digital Conversion: PCM, DM; Digital to Analog conversion: ASK,PSK,FSK,QAM; Modulation and Encoding: AM, FM, PM; Multiplexing: FDM, TDM, WDM; OSI &TCP/IP Model.

Error detection and correction: CRC, Checksum, Hamming Code;

Protocols: IP, ARP, RARP, TCP, UDP, SMTP, FTP, DNS, DHCP etc.

Text/Reference books:

1. Data Communications and Networking ,B. A. Forouzan, THM.
2. Computer Networks , A.S. Tanenbaum, PHI.
3. Data and Computer Communication, W. Stallings, PHI/ Pearson Education
4. Data & Computer Communication, Black, PHI.

DC12: a) Computer Graphics: 60 hours

Introduction: Basic concepts of Graphics Devices– Monochrome and Color Monitor displaying technique only, Physical and logical units of graphics devices –Pixel and its different properties, Basic idea for image or picture formation using pixels –Raster Scan and Vector Scan, Image Color Model, Color Coding, Lookup Table based color mapping.

Basic geometrical shapes formation algorithms: Concepts Co-ordinate System, Line Segment, Circle, elliptic segment and its formation; DDA, Bresenham's and Midpoint scan conversion algorithms.

Two and Three Dimensional Transformations: Geometric Transformations operations - Translation, Rotation, Scaling. Reflection, Shearing, Homogeneous coordinate system representation, matrix representation Coordinate Transformations operations - Translation, Rotation, Scaling. Reflection, Shearing, Composite Transformations Operations – Basic ideas and matrix representations by matrix concatenation for a particular operation.

Clipping: Point Clipping, Line Clipping – Region coding, Cohen-Sutherland Algorithm;

Area filling: Boundary fill and flood fill

Projection: Basic Concept of Projection operation and its application, Classification – Perspective, Parallel.

Applications: Basic Concepts Computer Art – publishing, drawing and drafting, Animation – Animating and modelling of real world, Morphing.

DC12: b) Computer Graphics lab using OpenGL: 40 hours

Some sample examples are given below. More problems can be included related to the theory. Use open source system.

1. Write a program to implement Bresenham's line drawing algorithm.
2. Write a program to implement mid-point circle drawing algorithm.
3. Write a program to clip a line using Cohen and Sutherland line clipping algorithm.
4. Write a program to apply various 2D transformations on a 2D object (use homogenous coordinates).
5. Write a program to apply various 3D transformations on a 3D object and then apply parallel and perspective projection on it.

Text/ Reference Books:

1. Computer Graphics by Zhigang Xiang, Roy Plastock, Schaum's Outlines Series.
2. Computer Graphics by Hern & Baker.
3. Procedural Elements for Computer Graphics by David F. Roger, 2nd Edition, TMH.
4. Computer Graphics by Folly &Vandam.

DSE1:E1: a) Introduction to Java Programming: 60 hours

Introduction to Java: Java Architecture and Features, Compiling and Executing a Java Program, Variables, Constants, Keywords Data Types, Operators (Arithmetic, Logical and Bitwise) and Expressions, Comments, Doing Basic Program Output, Decision Making Constructs (conditional statements and loops) and Nesting, Java Methods (Defining, Scope, Passing and Returning Arguments, Type Conversion and Type and Checking, Built-in Java Class Methods),

Arrays, Strings and I/O: Creating & Using Arrays (One Dimension and Multi-dimensional), Referencing Arrays Dynamically, Java Strings: The Java String class, Creating & Using String Objects, Manipulating Strings, String Immutability & Equality, Passing Strings To & From Methods, String Buffer Classes. Simple I/O using System.out and the Scanner class, Byte and Character streams, Reading/Writing from console and files.

Object-Oriented Programming Overview: Principles of Object-Oriented Programming, Defining & Using Classes, Controlling Access to Class Members, Class Constructors, Method Overloading, Class Variables & Methods, Objects as parameters, final classes, Object class, Garbage Collection.

Inheritance, Interfaces, Packages, Enumerations, Auto-boxing and Metadata: Single Level and Multilevel, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Packages, Extending interfaces and packages, Package and Class Visibility, Using Standard Java Packages (util, lang, io, net), Wrapper Classes, Autoboxing/Unboxing, Enumerations and Metadata.

Exception Handling, Threading, Networking and Database Connectivity: Exception types, uncaught exceptions, throw, built-in exceptions, Creating your own exceptions; Multi-threading: The Thread class and Runnable interface, creating single andmultiple threads. Accessing and manipulating databases using JDBC.

Applets and Event Handling: Java Applets: Introduction to Applets, Writing Java Applets, Working with Graphics, Incorporating Images & Sounds. Event Handling Mechanisms, Listener Interfaces, Adapter and Inner Classes. The design and Implementation of GUIs using the AWT controls, Swing components of Java Foundation Classes such as labels, buttons, text fields, layout managers, menus, events and listeners; Graphic objects for drawing figures such as lines, rectangles, ovals, using different fonts. Overview of servlets.

DSE1:E1: b) Java lab: 40 hours

Some sample examples are given below. More problems can be included related to the theory.

1. To find the sum of any number of integers entered as command line arguments

2. To find the factorial of a given number

3. To learn use of single dimensional array by defining the array dynamically.

4. To convert a decimal to binary number

5. To check if a number is prime or not, by taking the number as input from the keyboard

6. To find the sum of any number of integers interactively, i.e., entering every number from the keyboard, whereas the total number of integers is given as a command line argument

7. Write a program that show working of different functions of String and StringBufferclasss like setCharAt(, setLength(), append(), insert(), concat()and equals().

8. Write a program to create a ―distance‖ class with methods where distance is computed in terms of feet and inches, how to create objects of a class and to see the use of this pointer

9. Modify the ―distance‖ class by creating constructor for assigning values (feet and inches) to the distance object. Create another object and assign second object as reference variable to another object reference variable. Further create a third object which is a clone of the first object.

10. Write a program to show that during function overloading, if no matching argument is found, then java will apply automatic type conversions(from lower to higher data type)

11. Write a program to show the difference between public and private access specifiers. The program

should also show that primitive data types are passed by value and objects are passed by reference and to learn use of final keyword

12. Write a program to show the use of static functions and to pass variable length arguments in a function.

13. Write a program to demonstrate the concept of boxing and unboxing.

14. Create a multi-file program where in one file a string message is taken as input from the user and the function to display the message on the screen is given in another file (make use of Scanner package in this program).

15. Write a program to create a multilevel package and also creates a reusable class to generate Fibonacci series, where the function to generate Fibonacii series is given in a different file belonging to the same package.

16. Write a program that creates illustrates different levels of protection in classes/subclasses belonging to same package or different packages

17. Write a program ―DivideByZero‖ that takes two numbers a and b as input, computes a/b, and invokes Arithmetic Exception to generate a message when the denominator is zero.

18. Write a program to show the use of nested try statements that emphasizes the sequence of checking for catch handler statements.

19. Write a program to create your own exception types to handle situation specific to your application (Hint: Define a subclass of Exception which itself is a subclass of Throwable).

20. Write a program to demonstrate priorities among multiple threads.

21. Write a program to demonstrate multithread communication by implementing synchronization among threads (Hint: you can implement a simple producer and consumer problem).

22. Write a program to create URL object, create a URLConnection using the openConnection() method and then use it examine the different components of the URLand content.

23. Write a program to implement a simple datagram client and server in which a message that is typed into the server window is sent to the client side where it is displayed.

24. Write a program that creates a Banner and then creates a thread to scrolls the message in the banner from left to right across the applet„s window.

25. Write a program to get the URL/location of code (i.e. java code) and document(i.e. html file).

26. Write a program to demonstrate different mouse handling events like mouseClicked(), mouseEntered(), mouseExited(), mousePressed, mouseReleased() and mouseDragged().

27. Write a program to demonstrate different keyboard handling events.

28. Write a program to generate a window without an applet window using main() function.

Text/ Reference Books:

1. The Java Programming Language, Ken Arnold, James Gosling, David Homes.

2. Thinking in Java, Bruce Eckel, PHI.

3. Programming with Java, E. Balaguruswamy, McGraw Hill.

4. Java: How to Program , Paul Deitel, Harvey Deitel, Prentice Hall.

5. Head First Java, Orielly Media Inc. 2nd Edition, 2005.

6. Programming with JAVA, John R. Hubbard, Schaum's Series.

7. JAVA Programming for Core and Advanced Learners, Sagayraj, Denis, Karthik and Gajalashmi, Universities Press.

DSE1:E2: a) Introduction to Python Programming: 60 hours

Overview of Programming: Structure of a Python Program, Elements of Python

Introduction to Python: Python Interpreter, Using Python as calculator, Python shell, Indentation, Atoms, Identifiers and keywords, Literals, Strings, Operators(Arithmetic operator, Relational operator, Logical or Boolean operator, Assignment, Operator, Ternary operator, Bit wise operator)

Creating Python Programs: Input and Output Statements, Control statements (Branching, Looping, Conditional Statement, Exit function, Difference between break, continue and pass.), Defining Functions, default arguments, Exception handling.

Iteration and Recursion: Conditional execution, Alternative execution, Nested conditionals, Return statement, Recursion, Stack diagrams for recursive functions, Multiple assignment, while statement, for statement.

Strings and Lists: String as a compound data type, Length, Traversal and the for loop, String slices, String comparison, A find function, Looping and counting, List values, Accessing elements, List length, List membership, Lists and for loops, List operations, List deletion; Nested lists.

Object Oriented Programming: Introduction to Classes, Objects and Methods, Standard Libraries.

DSE1:E2: b) Python Programming Lab: 40 hours

Some sample examples are given below. More problems can be included related to the theory.

1. Running instructions in Interactive interpreter and a Python Script.
2. Write a program to compute distance between two points taking input from the user.
3. Write a program using a for loop that loops over a sequence.
4. Write a program to count the numbers of characters in the string and store them in a dictionary data structure.
5. Write a program to print each line of a file in reverse order.
6. Find mean, median, mode for the given set of numbers in a list using function

Text/ Reference Books:

1. Introduction to Computation and Programming Using Python, John V. Guttag, MIT Press.

2. Think Python: How to Think Like a Computer Scientist, Allen Downey, O’Reilly.

3. Learning Python, Mark Lutz, O’Reilly.

4. Python Programming for the Absolute Beginner, Michael Dawson, Cengage Learning.

5. Learning to Program in Python, P. M. Heathcote, PG Online Limited.

6. Python Programming Fundamentals, Authors: Lee and Kent D.

DSE2:E1: Operation Research: 60 hours

Introduction: Origin and development of operation research, Nature and characteristic features, models in O.R., application of O.R.
Linear Programming Problem: Introduction, mathematical formulation of the problem and graphical solution method.
Simplex Method: Introduction, computational procedure, artificial variable, problem of degeneracy, application of simplex method.
Duality: Concept, formulation of primal – dual, duality and simplex method, Dual Simplex method.
Transportation Problem: Introduction, mathematical formulation, finding initial basic feasible solution, optimality, degeneracy, unbalanced transportation problem.
Assignment Problem: Introduction, mathematical formulation and solution.
Game Theory: Some basic terminology, Two-person Zero-sum Game, Game without Saddle Point – Mixedstrategy, Algebraic method for 2×2 Game
Network Scheduling: Introduction, Critical Path Method (CPM), PERT calculation.

Text/ Reference Books :

1. Operations Research by Kanti Swarup, P.K. Gupta, Man Mohan, Sultan Chand & Sons

2. Schaum's Outline of Operations Research, Richard Bronson and GovindasamiNaadimuthu, McGraw-Hill Education
3. Operations Research: An Introduction, Hamady.A. Taha, TMH
4. Operations Research: Applications and Algorithms, Wayne L. Winston, Duxbury Press
5. Operations Research Techniques for Management by V.K.Kapoor, Sultan Chand and Sons
6. Introduction to Operations Research, Frederick S. Hillier and G. Lieberman, McGraw-Hill Higher Education

DSE2:E2: Intelligent System:60 hours

Introduction: Introduction to Artificial Intelligence, Background and Applications, Turing Test and Rational Agent approaches to AI, Introduction to Intelligent Agents, their structure, behavior and environment.
Problem Solving and Searching Techniques: Problem Characteristics, Production Systems, Control Strategies, Breadth First Search, Depth First Search, Hill climbing and its Variations, Heuristics Search Techniques: Best First Search, A* algorithm, Constraint Satisfaction Problem, Means-End Analysis, Introduction to Game Playing, Min-Max and Alpha-Beta pruning algorithms.
Knowledge Representation: Introduction to First Order Predicate Logic, Resolution Principle, Unification, Semantic Nets, Conceptual Dependencies, Frames, and Scripts, Production Rules, Conceptual Graphs. Programming in Logic (PROLOG)
Dealing with Uncertainty and Inconsistencies: Truth Maintenance System, Default Reasoning, Probabilistic Reasoning, Bayesian Probabilistic Inference, Possible World Representations.

Text/ Reference Books :

1, Introduction to A.I and Expert Systems, DAN.W Patterson– PHI.
2. Artificial Intelligence-A Modern Approach Russell &Norvig, **,**LPE, Pearson Prentice Hall.
3. Artificial Intelligence, Rich & Knight,– Tata McGraw Hill.
4. Programming in PROLOG ,W.F. Clocksin and Mellish, Narosa Publishing Hous,.
5. Prolog Programming for Artificial Intelligence ,IvanBratko, Addison-Wesley, Pearson Education.

DSE2: E3: Cloud Computing: 60 hours

Overview of Computing Paradigm: Recent trends in Computing: Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing,
Introduction to Cloud Computing: Introduction to Cloud Computing, History of Cloud Computing, Cloud service providers, Benefits and limitations of Cloud Computing
Cloud Computing Architecture: Comparison with traditional computing architecture (client/server), Services provided at various levels, Service Models- Infrastructure as a Service(IaaS), Platform as a Service(PaaS), Software as a Service(SaaS), How Cloud Computing Works, Deployment Models- Public cloud, Private cloud, Hybrid cloud, Community cloud, Case study of NIST architecture.
Case Studies: Case study of Service model using Google App Engine, Microsoft Azure, Amazon EC2, Eucalyptus.
Service Management in Cloud Computing: Service Level Agreements (SLAs), Billing & Accounting, Comparing Scaling Hardware: Traditional vs. Cloud, Economics of scaling.
Cloud Security: Infrastructure Security- Network level security, Host level security, Application level security, Data security and Storage- Data privacy and security Issues, Jurisdictional issues raised by Data location, Authentication in cloud computing.

Text/ Reference Books :

1. Cloud Computing Bible, Barrie Sosinsky, Wiley-India.

2. Cloud Computing: Principles and Paradigms, Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wiley.
3. Cloud Computing: Principles, Systems and Applications, Nikos Antonopoulos, Lee Gillam, Springer.
4. Cloud Computing: A Hands-on Approach, ArshdeepBahga and Vijay Madisetti, University Press.
5. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India.
6. Cloud Computing, A Practical Approach, Toby Velte, Anthony Velte, Robert Elsenpeter, McGraw Hills.
7. Cloud Computing Strategies , Dimitris N. Chorafas, CRC Press.

DSE2: E4: Theory of Computation: 60 hours

Finite Automata: Definition of a Finite Automaton, Model, Representation, Classification – with respect to output function Mealy and Moore Machines, with respect to State Transition – Deterministic and Non-Deterministic Machine, Examples, conversion algorithms Mealy to Moore and Moore to Mealy, Non-Deterministic to equivalent Deterministic Finite automata, Finite and Infinite state machines, Removal of Null-transitions, Acceptability of String by a Finite Automaton, Design of different Finite State Machines, Minimized Equivalent Machine.

Formal Languages and Grammar: Introduction to Formal Grammar and Language, Formal Definition, Chomsky's Classification of Grammar – Type 0, Type-1 or Context Sensitive, Type-2 or Context Free and Type-3 or Regular Grammar, Illustration of each of these classes with example, Sentential form, Sentences – Languages or strings, Derivations – left, right derivation, Derivation tree, Parse Tree, Syntax Tree, Ambiguous Grammar and Language, Designing of Grammar for a language, Finding Language for Given Grammar; Definition and basic idea about Push Down Automaton

Regular Expression: Basic Idea and Definition, Regular Expression basic Identities, Arden's Theorem and application for reduction of equivalent regular expressions, Thompson's Construction Algorithm – Regular expression to Finite Automata conversion, State Transition System to Regular Expression conversion algorithm by Arden's Algebraic Method, FA to Regular Grammar and Regular Grammar to FA conversion algorithms and applications.

Turing Machine: Concepts of Turing Machine, Formal Definitions, Classifications – Deterministic and Non-Deterministic Turing Machines, Simple Design of Turing Machines like – Unary Adder, Subtractor, Concatenator, Odd / even count etc and concepts of Universal Turing Machines.

Text/ Reference Books:

1. Introduction to Automata Theory, Languages, and Computation by John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, 3rd Edition, Pearson.
2. Theory of Computer Science (Automata, Languages & Computation) by K L P Misra & N Chandrasekharan, PHI.
3. Introduction to Theory of Computation by Micheal Sipser, Cengage Learning.
4. Switching and Finite Automata Theory by Zvi Kohavi, Niraj. K. Jha, TMH.
5. Formal Language and Automata, P. Linz, Narosa

SEC-1: Sensor Network & IOT : 60 hours

IoT Architecture-State of the Art – Introduction, State of the art
Architecture Reference Model- Introduction, Reference Model and architecture, IoT reference Model.

M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management.
M2M to IoT – A Market Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview– Building architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.
IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.
Real-World Design Constraints- Introduction, Technical Design constraintshardware is popular again, Data representation and visualization, Interaction and remote control.
Industrial Automation- Service-oriented architecturebased device integration, SOCRADES: realizing the enterprise integrated Web of Things, IMC-AESOP: from the Web of Things to the Cloud of Things

Text/ Reference Books :

1. Wireless Sensor Network by Sohraby, Minoli and Znati, Wiley Publications.
2. Wireless Sensor Network: A network perspective by Zheng & Abbas, Wiley.
3. Building Wireless Sensor Network by Faludi, O'Reilly.
4. Wireless Sensor Network: from theory to application by Ibrahiem, Ramakrishnan, CRC Press.
5. Wireless Sensor Network by H Mahmoud Ahmed Fahmy, Springer.
6. Internet of Things by Bahga, Madishetty, Orient Blackswanpvt Ltd.
7. IOT fundamentals, David, Pearson Education.
8. Internet of Things by Tripathy and Anuradha, CRC Press.
9. From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, Academic Press.

SEM-VI

DC13: Software Engineering: 60 hours

Introduction: Defining system, open and closed system, modelling of system through computer hardware, communication systems, external agents and software systems; Importance of Engineering Methodology towards computerization of a system

Software Life Cycle: Classical and Iterative Waterfall Model; Spiral Model and its importance towards application for different system representations, Comparative Studies

Software Requirement and Specification Analysis: Requirements Principles and its analysis principles; Specification Principles and its representations

Software Design Analysis – Different level of DFD Design, Physical and Logical DFD, Use and Conversions between them, Process Representation – Pseudo English, Tight English, Decision Tables and Trees, Structured analysis – Structure Chart Conversion from DFD: Transform Centric and Transaction Centric conversions algorithms, Coupling and Cohesion of the different modules Software Cost Estimation Modelling – Heuristic and Empirical Modelling; COCOMO

Software Testing: Software Verification and Validation; Testing objectives, Testing Principles, Testability; Error and Faults; Unit Testing, White Box and Blank Box Testing, Test Case Design: Test Vector.

Software Quality Assurances: Concepts of Quality, Quality Control, Quality Assurance, SQA Activities, IEEE Standard for Statistical Software Quality Assurances (SSQA) criterions.

Text/ Reference Books:

1. Software Engineering: A Practitioner's Approach by R.S. Pressman, McGraw-Hill.
2. An Integrated Approach to Software Engineering by P. Jalote, Narosa Publishing House.
3. Software Engineering by K.K. Aggarwal and Y. Singh, New Age International Publishers.
4. Software Engineering by I. Sommerville, Addison Wesle.
5. Software Engineering for Students by D. Bell, Addison-Wesley.
6. Fundamentals of Software Engineering by R. Mall, PHI.

DC14: Web Design: 60 hours

Introduction: Introduction to Markup Languages and HTML5 need and use; the Head, the Body, Colors, Attributes, Lists, ordered and unordered etc.

Links, Images and Tables: Introduction; Relative Links, Absolute Links; Link Attributes; Using the ID Attribute to Link Within a Document; Putting an Image on a Page, Using Images as Links, Putting an Image in the Background, Creating a Table, Table Headers, Captions, Spanning Multiple Columns, Styling Table etc.

Introduction to XML: Introduction to XML and its Goals, XML Structure and Syntax, Document classes and Rules, Scripting XML, XML as Data, Linking with XML, XSL –Style Sheet Basics, XSL basics, XSL style sheets.

Introduction to JavaScript: Advantage of JavaScript - JavaScript Syntax – Data type - Variable - Array - Operator and Expression - Looping Constructor - Function - Dialog box.

JavaScript document object model: Introduction - Object in HTML - Event Handling - Window Object - Document object - Browser Object - Form Object - Navigator object Screen object - Build in Object - User defined object - Cookies.

Text/ Reference Books:

1. Internet & world wide web How to program, Deitel & Deitel, Pearson Education
2. Web Enable Commercial Application Development Using HTML, DHTML, JavaScript, Pen CGI, I. Bayross, BPB Publications.
3. Mastering JavaScript, J. Jaworski, BPB Publications.
4. Complete Reference HTML, T. A. Powell, TMH.
5. Introduction to HTML and CSS, Cassidy Williams, Camryn Williams, O'Reilly.
6. Learning PHP, MySQL, JavaScript, CSS & HTML5, Robin Nixon, O'reilly.

DSE-3:E1: Digital Image Processing: 60 hours

Introduction: Image definition and its representation, Pixels, Co-ordinate conventions, Image formats (Study of the image matrix), neighbourhood metrics, Sampling and quantization, Types of distance measure (concept only).

Spatial Domain: Image enhancement techniques in spatial domain, Contrast stretching, Histogram Processing, Noise smoothing, Sharpening, Pixel Classification.

Thresholding: Grey level thresholding, global/ local thresholding, Iterative thresholding, Edge detection operators, Region growing, Split/ merge techniques, Image feature/ primitive extraction, Background correction, Color enhancement.

Image restoration: Basic Framework, Interactive Restoration, Image deformation and geometric transformations, image morphing, Restoration techniques, Noise characterization, Noise restoration filters, Restoration from projections, Hough transform, Huffman coding, Segmentation.

Image Segmentation: Boundary detection based techniques, Point, line detection, Edge detection, Local processing.

Text/ Reference Books:

1. Digital Image Processing by Gonzalez, Pearson.
2. Digital Image Processing by Jayaraman and Veerakumar, TMH.
3. Digital Image Processing using MATLAB by Gonzalez, Eddins and Woods, McGraw Hill.
4. Digital Image Processing by Annadurai, Pearson.
5. Digital Image Processing; A remote sensing perspective by Jensen, Pearson.
6. Digital Image Processing by Castleman, Pearson.
7. Digital Image Processing and Analysis, B. Chanda and D. Dutta Majumder, PHI, New Delhi.

DSE-3:E2: Introduction to Data Science: 60 hours

Introduction: Data Analytics Lifecycle Overview, Data Preparation, Model Planning, Model Building;

Clustering: K-means; **Association Rules:**Apriori Algorithm;

Regression: Linear Regression; **Classification:** Decision Trees: Overview of a Decision Tree, Decision Tree Algorithms, Evaluating a Decision Tree;

The Basics of NumPy Arrays; Basics of Data Manipulation with Pandas and Visualization with Matplotlib.

Text/ Reference Books:

1. Introducing Data Science, D. Cielen, Arno D. B. Meysman, M. Ali, Dreamtech Press.
2. Doing Data Science: Straight Talk from the Frontiline , Rachel Schutt, Cathy O'Neil, by Schroff/O'Reilly.
3. Data Science for Business" What You Need to Know About Data Mining and Data-Analytic Thinking Foster Provost, Tom Fawcettby O'Reilly.
4. Data Smart: Using data Science to Transform Information into Insight, John W. Foreman, by John Wiley & Sons.
5. Super Crunchers: Why Thinking-by-Numbers Is the New Way to Be Smart, Ian Ayres by Bantam.
6. Python Data Science Handbook: Essential Tools for Working with Data, Jake Vander Plas by O’Reilly

DSE-3:E3: Soft Computing: 60 hours

Introduction: Introduction to soft computing; introduction to fuzzy sets and fuzzy logic systems; introduction to biological and artificial neural network; introduction to Genetic Algorithm.

Fuzzy Logic: Classical Sets and Fuzzy Sets and Fuzzy relations: Operations on Classical sets, properties of classical sets, Fuzzy set operations, properties of fuzzy sets, cardinality, operations, and properties of fuzzy relations.

Membership functions: Features of membership functions, standard forms and boundaries, different fuzzification methods.

Fuzzy to Crisp conversions: Lambda Cuts for fuzzy sets, fuzzy Relations, Defuzzification methods.

Classical Logic and Fuzzy Logic: Classical predicate logic, Fuzzy Logic, Approximate reasoning and Fuzzy Implication

Fuzzy Rule based Systems: Linguistic Hedges, Fuzzy Rule based system – Aggregation of fuzzy Rules, Fuzzy Inference System, Mamdani Fuzzy Models – Takagi-Sugeno Fuzzy Models.

Neural Networks: Introduction to Neural Networks: Advent of Modern Neuroscience, Classical AI and Neural Networks, Biological Neurons and Artificial neural network; model of artificial neuron.

Learning Methods: Hebbian, competitive, Boltzman.

Neural Network models: Perceptron, Adaline and Madaline networks; single layer network; Delta rule and back-propagation; and multi layer networks.

Text/ Reference Books:

1. Fuzzy logic with engineering applications, Timothy J. Ross, John Wiley and Sons.
2. Neural Networks, Fuzzy Logic and Genetic Algorithms, S. Rajasekaran and G.A.V.Pai, PHI.
3. Principles of Soft Computing , S N Sivanandam, S. Sumathi, John Wiley & Sons.
4. Neuro-Fuzzy and Soft computing, Jang, Sun, Mizutani, PHI.
5. Neural Networks: A Classroom Approach,1/e by Kumar Satish, TMH.
6. A beginners approach to Soft Computing, Samir Roy &Udit Chakraborty.
7. Soft Computing: Fundamentals and Applications, by D. K. Pratihar.

DSE-4: Project

Guidelines: Each student of BCA (Honours) SEM- VI will carry out one project work under the supervision of a faculty member of the college. The project will be assigned at the beginning of SEM-VI academic session. The maximum size of student group can be of three (03) students. The student will submit a project report representing the actual work in a suitable format. The student should defend the project before the examiners. The project work will be evaluated on the basis of presentation and viva-voce examination. The examination will be as per University guidelines.

Project Report should contain the following:

1 Title of the Project
2 Objectives of the Project
3 Analysis Report in a suitable format
4 Detailed Design steps
5 Circuit Layout/Program Listing
6 Testing and Analysis
7 Conclusion and future scope for development
8 Bibliography

Broad areas: Computer Networking, Network Protocol, Application DBMS, Multimedia, Graphics, Internet based application, Software Engineering Tool Development, Simulation, any other related topics, I/O Controller, I/O interfaces, Microprocessor based system, IOT based system etc.

Marks Allotment:

Project Report	08 marks
Presentation	07 marks
Project Work	20 marks
Viva-voce	15 marks

SEC-2: Introduction to PHP: 60 hours

Introduction: PHP introduction, inventions and versions, scope, important tools and software requirements (like Web Server, Database, Editors etc.), 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 associatively.

Handling HTML form with PHP: Basic Input and Attributes, Other Kinds of Inputs, Styling forms with CSS, Where to Go from Here 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 Loops, Goto, Break, Continue and exit.

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, Creating and accessing String, Searching & Replacing String; Formatting, joining and splitting String, String Related Library functions;

Array: Anatomy of an 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. PHP database (MySQL) interface.

Text/ Reference Books:

1. PHP: The Complete Reference Paperback, Steven Holzner, McGraw Hill Education (India).

2. PHP and MYSQL (Create-Modify-Reuse), Timothy Boronczyk, Martin E. Psinas, Wiley India Private Limited.

3. Learning PHP, MySQL, JavaScript, CSS & HTML5, Robin Nixon, O'reilly.

4. PHP and MySQL Web Development, Luke Welling, Laura Thompson, Addison-Wesley Professional.