CHOICE BASED CREDIT SYSTEM

B.Sc. HONOURS With Computer Application

Semester			credit
I	CORE	CMAACOR01T: Programming Fundamental using C CMAACOR01P: Programming Fundamental using C CMAACOR02T: Computer Fundamental	4 2 5+1
	GE1	Physics / Math / Electronics / Chemistry / Microbiology / Food & Nutrition Economics / Geography / English / Journalism & Mass-communication / Commerce	/6
	AECC	Environmental Science	2
II	CORE	CMAACOR03T: Data Structure CMAACOR03P: Data Structure CMAACOR04T: Computer System Architecture	4 2 5 + 1
	GE2	Physics / Math / Electronics / Chemistry / Microbiology / Food & Nutrition Economics / Geography / English / Journalism & Mass-communication / Commerce	/6
	AECC	English	2
III	CORE	CMAACOR05T: Database Management Systems CMAACOR05P: Database Management Systems CMAACOR06T: Operating System CMAACOR06P: Operating System CMAACOR07T: Discrete Structure	4 2 4 2 5 +1
	GE3	Physics / Math / Electronics / Chemistry / Microbiology / Food & Nutrition Economics / Geography / English / Journalism & Mass-communication / Commerce	/6
	SEC1	CMSSSEC001:Programming in Python	2
IV	CORE	CMAACOR08T: Multimedia Systems and Internet Technologies CMAACOR08P: Multimedia Systems and Internet Technologies CMAACOR09T: OOP's using JAVA CMAACOR09P: OOP's using JAVA CMAACOR10T: Software Engineering	4 2 4 2 5+1
	GE4	Physics / Math / Electronics / Chemistry / Microbiology / Food & Nutrition Economics / Geography / English / Journalism & Mass-communication / Commerce	/6
	SEC2	CMSSSEC002:R Programming	2
V	CORE	CMAACOR11T: Artificial Intelligence CMAACOR11P: Artificial Intelligence CMAACOR12T: Computer Networks	4 2 5+1
	DSE (Any two)	CMAADSE01T: Introduction to Data Science CMAADSE01P: Introduction to Data Science CMAADSE02T: Visual Programming CMAADSE02P: Visual Programming CMAADSE03T: Data Mining CMAADSE03P: Data Mining	4 2 4 2 4 2
VI	CORE	CMAACOR13T: Design & Analysis of Algorithm CMAACOR13P: Design & Analysis of Algorithm CMAACOR14T: Theory of Computation	4 2 5+1
	DSE (Any two)	CMAADSE04T: Information Security and Cyber Laws CMAADSE05T: Cloud Computing CMAADSE05P: Cloud Computing CMAADSE06P: Project	5+1 4 2 6
Total number of courses		26	140

CORE COURSES BCA (HONOURS)

CMAACOR01T: Programming Fundamentals using C **Theory: 60 Lectures**

1. Introduction to C **(5 Lectures)**
History of C , Overview of Procedural Programming Using main() function, Compiling and Executing Simple Programs in C.

2. Data Types, Variables, Constants, Operators and Basic I/O **(8 Lectures)**
Declaring, Defining and Initializing Variables, Scope of Variables, Using Named Constants, Keywords, Data Types, Casting of Data Types, Operators (Arithmetic, Logical and Bitwise), Using Comments in programs, Character I/O (getc, getchar, putc, putcharetc), Formatted and Console I/O (printf(), scanf(), cin, cout), Using Basic Header Files (stdio.h, conio.h etc).

3. Expressions, Conditional Statements and Iterative Statements **(8 Lectures)**
Simple Expressions in C (including Unary Operator Expressions, Binary Operator Expressions), Understanding Operators Precedence in Expressions, Conditional Statements (if construct, switch-case construct), Understanding syntax and utility of Iterative Statements (while, do-while, and for loops), Use of break and continue in Loops, Using Nested Statements (Conditional as well as Iterative)

4. Functions and Arrays **(15 Lectures)**
Utility of functions, Call by Value, Call by Reference, Functions returning value, Void functions, Inline Functions, Return data type of functions, Functions parameters, Differentiating between Declaration and Definition of Functions, Command Line Arguments/Parameters in Functions, Functions with variable number of Arguments. Creating and Using One Dimensional Arrays (Declaring and Defining an Array, Initializing an Array, Accessing individual elements in an Array, Manipulating array elements using loops), Use Various types of arrays (integer, float and character arrays / Strings) Two-dimensional Arrays (Declaring, Defining and Initializing Two Dimensional Array, Working with Rows and Columns), Introduction to Multi-dimensional arrays

5. Derived Data Types (Structures and Unions) **(3 Lectures)**
Understanding utility of structures and unions, Declaring, initializing and using simple structures and unions, Manipulating individual members of structures and unions, Array of Structures, Individual data members as structures, Passing and returning structures from functions, Structure with union as members, Union with structures as members.

6. Pointers in C **(10 Lectures)**
Understanding a Pointer Variable, Simple use of Pointers (Declaring and Dereferencing Pointers to simple variables), Pointers to Pointers, Pointers to structures, Problems with Pointers, Passing pointers as function arguments, Returning a pointer from a function, using arrays as pointers, Passing arrays to functions. Pointers vs. References, Declaring and initializing references, Using references as function arguments and function return values

7. Memory Allocation in C **(6 Lectures)**
Differentiating between static and dynamic memory allocation, use of malloc, calloc and free functions, use of new and delete operators, storage of variables in static and dynamic memory allocation

8. File I/O, Preprocessor Directives **(5 Lectures)**
Opening and closing a file (use of fstream header file, ifstream, ofstream and fstream classes), Reading and writing Text Files, Using put(), get(), read() and write() functions, Random access in files, Understanding the Preprocessor Directives (#include, #define, #error, #if, #else, #elif, #endif, #ifdef, #ifndef and #undef), Macros

Recommended Books:

1. Programming in ANSI C (TMH) Balaguruswamy
2. The C Programmi9ng languages (prentice Hall) Riche
3. Programming with C (TMH) Gottfried

CMAACOR01P: Programming Fundamentals using C Practical: **60 Lectures**

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. Create a structure Student containing fields for Roll No., Name, Class, Year and Total Marks. Create 10 students and store them in a file.
23. Write a program to retrieve the student information from file created in previous question and print it in following format:
Roll No. Name Marks
24. Open the file in question 12 and append 5 more records into the file. Print all records.
25. Write a menu to
i) Create a sequential file
ii) Print records
iii) Add records
26. Copy the contents of one text file to another file, after removing all whitespaces.

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

CMAACOR02T: Computer Fundamentals and Digital Principles **Theory: 75 Lectures**

1.Introduction: **(6 Lectures)**
Functional units of a Computer Systems,Different Types of computers, Software and Hardware,Types of software:System s/w and Application s/w,Operating System as user interfaces,Basic functions of OS,different types of OS

2.Data Representation: **(8 Lectures)**
Base or radix, Number systems(Decimal,Binary,Octal and Hexadecimal) ,Conversion from one number system to another, binary arithmetic(addition and subtraction),Integer representation(Signed magnitude,1's complement,2's complement),Character representation and Floating Point representation,

3.Boolean Algebra and Digital Logic: **(14 Lectures)**
Logic Gates:AND,OR & NOT(basic logic gates),NAND & NOR(universal logic gates),XOR,XNOR(graphical symbol,truth table and Boolean expression of all logic gates),Basic laws of Boolean Algebra,De Morgan's theorems,Cannonical expressions,min terms and max terms, SOP and POS expressions and their conversion, Simplifications of expressions by both boolean algebra and K-MAP method(upto 4 variables),Don't-care conditions,Representation of simplified boolean expressions by NAND/NOR gates

4.Combinational and Sequential Logic: **(14 Lectures)**
Sequential logic circuits:Adder(half adder and full adder), Subtractor (half subtractor and full subtractor), Encoder,Decoder, Multiplexer & Demultiplexer Combinational logic circuits:Flip-flops:latch,clocked,Types of flip-flops(RS,JK,D,T):characteristic tables, Excitation table and logic diagram,Registers,shift registers,registers with parallel loads, Counters,Types of counters:synchronous and asynchronous(diagram and explanation of how it counts)

5.Devices: **(6 Lectures)**
Input and output devices (with connections and practical demo),
keyboard, mouse, joystick, scanner, OCR, OMR, bar code reader, web camera,
monitor, printer, plotter

6.Memory: **(6 Lectures)**
Primary, secondary, auxiliary memory, RAM, ROM, cache memory, hard disks, optical disks

7.Computer Organisation and Architecture: **(10 Lectures)**
C.P.U., registers, system bus, , Inside a computer, SMPS, Motherboard, Ports and Interfaces, expansion cards, ribbon cables, memory chips.

8.Overview of Emerging Technologies: **(8 Lectures)**
Bluetooth, cloud computing, big data, data mining, mobile computing and embedded systems.

9.Use of Computers in Education and Research: **(3 Lectures)**
Data analysis, Heterogeneous storage, e-Library, Google Scholar, Domain specific packages such as SPSS, Mathematica etc.

Reference Books:
1. A. Goel, Computer Fundamentals, Pearson Education, 2010.
2. P. Aksoy, L. DeNardis, Introduction to Information Technology, Cengage Learning, 2006
3. P. K.Sinha, P. Sinha, Fundamentals of Computers, BPB Publishers, 2007
4.Peter Nortons-Introduction to Computers,Sixth edition,TMG
5.Morris Mano-Digital Logic and Computer Design,Fourth Edition,Pearson

CMAACOR03T: Data Structures **Theory: 60 Lectures**

1.**Introduction:** **(6 Lectures)**

Data Object, Abstract Data Type (ADT) Data structure, Defination, Types and properties, Data types.

2. **Arrays** **(5 Lectures)**

Single and Multi-dimensional Arrays, Sparse Matrices (Array and Linked Representation)

3.**Stacks** **(5 Lectures)**

Implementing single / multiple stack/s 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

4.**Linked Lists** **(8 Lectures)**

Singly, Doubly and Circular Lists (Array and Linked representation); Normal and Circular representation of Stack in Lists; Self Organizing Lists; Skip Lists

5.**Queues** **(5 Lectures)**

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

6. **Recursion** **(5 lectures)**

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

7.**Trees** **(20 Lectures)**

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

8.**Searching and Sorting** **(5 Lectures)**

Linear Search, Binary Search, Comparison of Linear and Binary Search, Selection Sort, Insertion Sort, bubble Sort, Comparison of Sorting Techniques

9.**Hashing** **(5 Lectures)**

Introduction to Hashing, Resolving collusion by Open Addressing, Coalesced Hashing, Separate Chaining, Choosing a Hash Function, Perfect Hashing Function

Recommended Books:

1. Adam Drozdek, "Data Structures and algorithm in C", Third Edition, Cengage Learning, 2012.
2. SartajSahni, Data Structures, "Algorithms and applications in C", Second Edition, Universities Press, 2011.
3. Aaron M. Tenenbaum, Moshe J. Augenstein, YedidyahLangsam, "Data Structures Using C and C:, Second edition, PHI, 2009.
4. Robert L. Kruse, "Data Structures and Program Design in C", Pearson,1999.
5. D.S Malik, Data Structure using C,Second edition, Cengage Learning, 2010.
6. Mark Allen Weiss, "Data Structures and Algorithms Analysis in Java", Pearson Education, 3rd edition, 2011
7. Aaron M. Tenenbaum, Moshe J. Augenstein, YedidyahLangsam, "Data Structures Using Java, 2003.
8. Robert Lafore, "Data Structures and Algorithms in Java, 2/E", Pearson/ Macmillan Computer Pub,2003
9. John Hubbard, "Data Structures with JAVA", McGraw Hill Education (India) Private Limited; 2 edition, 2009
10. Goodrich, M. and Tamassia, R. "Data Structures and Algorithms Analysis in Java", 4th Edition, Wiley,2013
11. Herbert Schildt, "Java The Complete Reference (English) 9th Edition Paperback", Tata McGraw Hill, 2014.
12. 12. D. S. Malik, P.S. Nair, "Data Structures Using Java", Course Technology, 2003.

CMAACOR03P: Data Structures Lab **Practical: 60 Lectures**

1. Write a program to search an element from a list. Give user the option to perform Linear or Binary search. Use Template functions.
2. WAP using templates to sort a list of elements. Give user the option to perform sorting using Insertion sort, Bubble sort or Selection sort.
3. Implement Linked List using templates. Include functions for insertion, deletion and search of a number, reverse the list

and concatenate two linked lists (include a function and also overload operator +).
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 using templates. 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. Use Templates.
8. Perform Queues operations using Circular Array implementation. Use Templates.
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 polynomial.
11. WAP to calculate factorial and to compute the factors of a given no. (i)using recursion,
(ii) using iteration
12. (ii) 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:
i. Insertion (Recursive and Iterative Implementation)
ii. Deletion by copying
iii. Deletion by Merging
iv. Search a no. in BST
v. Display its preorder, postorder and inorder traversals Recursively
vi. Display its preorder, postorder and inorder traversals Iteratively
vii. Display its level-by-level traversals
viii. Count the non-leaf nodes and leaf nodes
ix. Display height of tree
x. Create a mirror image of tree
xi. Check whether two BSTs are equal or not
15. WAP to convert the Sparse Matrix into non-zero form and vice-versa.
16. WAP to reverse the order of the elements in the stack using additional stack.
17. WAP to reverse the order of the elements in the stack using additional Queue.
18. WAP to implement Diagonal Matrix using one-dimensional array.
19. WAP to implement Lower Triangular Matrix using one-dimensional array.
20. WAP to implement Upper Triangular Matrix using one-dimensional array.
21. WAP to implement Symmetric Matrix using one-dimensional array.
22. WAP to create a Threaded Binary Tree as per inorder traversal, and implement operations like finding the successor / predecessor of an element, insert an element, inorder traversal.
23. WAP to implement various operations on AVL Tree.

CMAACOR04T: Computer System Architecture **Theory: 75Lectures**

1. Introduction **(5 Lectures)**
Combinational logic circuit and sequential logic circuit (basic concepts with example)

2. Data Representation and Basic Computer Arithmetic **(13 Lectures)**
Number systems, complements, fixed and floating point representation, character representation, addition, subtraction, magnitude comparison, multiplication and division algorithms for integers

3. Basic Computer Organization and Design **(15 Lectures)**
Registers, bus system, instruction set, timing and control, instruction cycle, memory reference, input -output and interrupt, Interconnection Structures, Bus Interconnection design of basic computer.

4. Central Processing Unit **(20 Lectures)**
Register organization, arithmetic and logical micro-operations, stack organization, micro programmed control. Instruction formats, addressing modes, instruction codes, machine language, assembly language, input output programming, RISC, CISC architectures, pipelining and parallel architecture.

5. Memory Organization **(12Lectures)**
Main Memory, Auxiliary Memory, Associative memory, Cache memory,mapping.

6. Input-Output Organization **(10 Lectures)**

Input / Output: External Devices, I/O Modules, Programmed I/O, Interrupt-Driven I/O, Direct Memory Access, I/O Channels, I/OP

Recommended Books:

1. M. Mano, Computer System Architecture, Pearson Education, 1992
2. A. J. Dos Reis, Assembly Language and Computer Architecture using C and JAVA, Course Technology, 2004
3. W. Stallings, Computer Organization and Architecture Designing for Performance, 8 Edition, Prentice Hall of India, 2009
4. Carl Hamacher, Computer Organization, Fifth edition, McGrawHill, 2012.

CMAACOR05T: Database Management Systems **Theory: 60 Lectures**

1. Introduction **(6 Lectures)**

Characteristics of database approach, data models, database system architecture and data independence.

2. Entity Relationship(ER) Modeling **(8 Lectures)**

Entity types, relationships, constraints.

3. Relation Data Model **(20 Lectures)**

Relational model concepts, relational constraints, relational algebra, SQLqueries

4. Database Design **(15 Lectures)**

Mapping ER/EER model to relational database, functional dependencies,Lossless decomposition, Normal forms (upto BCNF).

5. Transaction Processing **(3 Lectures)**

ACID properties, concurrency control with locks

6. File Structure and Indexing with application **(8 Lectures)**

Operations on files, File of Unordered and ordered records, overview of File organizations, Indexing structures for files(Primary index, secondary index, clustering index), Multilevel indexing using B and B+ trees.

Recommended Books:

1. R. Elmasri, S.B. Navathe, Fundamentals of Database Systems 6th Edition, Pearson Education, 2010.
2. R. Ramakrishanan, J. Gehrke, Database Management Systems 3rd Edition, McGraw-Hill, 2002.
3. A. Silberschatz, H.F. Korth, S. Sudarshan, Database System Concepts 6th Edition, McGraw Hill, 2010.
4. R. Elmasri, S.B. Navathe Database Systems Models, Languages, Design and application Programming, 6th Edition, Pearson Education, 2013.

CMAACOR05P: Database Management Systems Lab **Practical: 60 Lectures**

Create and use the following database schema to answer the given queries.

EMPLOYEE Schema

Field	Type	NULL	KEY	DEFAULT
Eno	Char(3)	NO	PRI	NIL
Ename	Varchar(50)	NO		NIL
Job_type	Varchar(50)	NO		NIL
Manager	Char(3)	Yes	FK	NIL
Hire_date	Date	NO		NIL
Dno	Integer	YES	FK	NIL
Commission	Decimal(10,2)	YES		NIL

Salary	Decimal(7,2)	NO	NIL

DEPARTMENT Schema

Field	Type	NULL KEY	DEFAULT
Dno	Integer	No PRI	NULL
Dname	Varchar(50)	Yes	NULL
Location	Varchar(50)	Yes	New Delhi

Query List

1. Query to display Employee Name, Job, Hire Date, Employee Number; for each employee with the Employee Number appearing first.
2. Query to display unique Jobs from the Employee Table.
3. Query to display the Employee Name concatenated by a Job separated by a comma. Multimedia Systems and Internet Technologies
4. Query to display all the data from the Employee Table. Separate each Column by a comma and name the said column as THE_OUTPUT.
5. Query to display the Employee Name and Salary of all the employees earning more than $2850.
6. Query to display Employee Name and Department Number for the Employee No= 7900.
7. Query to display Employee Name and Salary for all employees whose salary is not in the range of $1500 and $2850.
8. Query to display Employee Name and Department No. of all the employees in Dept 10 and Dept 30 in the alphabetical order by name.
9. Query to display Name and Hire Date of every Employee who was hired in 1981.
10. Query to display Name and Job of all employees who don‘t have a current Manager.
11. Query to display the Name, Salary and Commission for all the employees who earn commission.
12. Sort the data in descending order of Salary and Commission.
13. Query to display Name of all the employees where the third letter of their name is _A‘.
14. Query to display Name of all employees either have two _R‘s or have two _A‘s in their name and are either in Dept No = 30 or their Manger‘s Employee No = 7788.
15. Query to display Name, Salary and Commission for all employees whose Commission Amount is 14 greater than their Salary increased by 5%.
16. Query to display the Current Date.
17. Query to display Name, Hire Date and Salary Review Date which is the 1st Monday after six months of employment.
18. Query to display Name and calculate the number of months between today and the date each employee was hired.
19. Query to display the following for each employee <E-Name> earns < Salary> monthly but wants < 3 * Current Salary >. Label the Column as Dream Salary.
20. Query to display Name with the 1st letter capitalized and all other letter lower case and length of their name of all the employees whose name starts with _J‘, ‘A‘ and _M‘.
21. Query to display Name, Hire Date and Day of the week on which the employee started.
22. Query to display Name, Department Name and Department No for all the employees.
23. Query to display Unique Listing of all Jobs that are in Department # 30.
24. Query to display Name, Dept Name of all employees who have an _A‘ in their name.
25. Query to display Name, Job, Department No. And Department Name for all the employees working at the Dallas location.
26. Query to display Name and Employee no. Along with their Manger‘s Name and the Manager‘s employee no; along with the Employees‘ Name who do not have a Manager.
27. Query to display Name, Dept No. And Salary of any employee whose department No. and salary matches both the department no. And the salary of any employee who earns a commission.
28. Query to display Name and Salaries represented by asterisks, where each asterisk (*) signifies $100.
29. Query to display the Highest, Lowest, Sum and Average Salaries of all the employees
30. Query to display the number of employees performing the same Job type functions.
31. Query to display the no. of managers without listing their names.
32. Query to display the Department Name, Location Name, No. of Employees and the average salary for all employees in that department.
33. Query to display Name and Hire Date for all employees in the same dept. as Blake.
34. Query to display the Employee No. And Name for all employees who earn more than the average salary.

35. Query to display Employee Number and Name for all employees who work in a department with any employee whose name contains a _T‘.
36. Query to display the names and salaries of all employees who report to King.
37. Query to display the department no, name and job for all employees in the Sales department.
38. Basics of Pl/SQL and there use in query management.

CMAACOR06T: Operating Systems **Theory: 60 Lectures**

1. Introduction **(10 Lectures)**
Basic OS functions, resource abstraction, types of operating systems–multiprogramming systems, batch systems , time sharing systems; operating systems for personal computers & workstations, process control & real time systems.

2. Operating System Organization **(6 Lectures)**
Processor and user modes, kernels, system calls and systemprograms.

3. Process Management **(20Lectures)**
System view of the process and resources, process abstraction, processhierarchy, threads, threading issues, thread libraries; Process Scheduling, non-pre-emptive and pre-emptive scheduling algorithms; concurrent and processes, critical section, semaphores, methods for inter-process communication; deadlocks.

4.Memory Management **(8 Lectures)**
Physical and virtual address space; memory allocation strategies -fixedand variable partitions, paging, segmentation, virtual memory

5.File and I/O Management **(8 Lectures)**
Directory structure, file operations, file allocation methods, device management.

6. Application of Protection and Security **(4 Lectures)**
Policy mechanism, Authentication, Internal access Authorization.

7: Case Study of OS : Unix/Linux **(4 Lectures)**

Recommended Books:

1. Silberschatz, P.B. Galvin, G. Gagne, Operating Systems Concepts, 8th Edition, John Wiley Publications 2008.
2. A.S. Tanenbaum, Modern Operating Systems, 3rd Edition, Pearson Education 2007.
3. G. Nutt, Operating Systems: A Modern Perspective, 2nd Edition Pearson Education 1997.
4. W. Stallings, Operating Systems, Internals & Design Principles, 5th Edition, Prentice Hall of India. 2008.
5. M. Milenkovic, Operating Systems- Concepts and design, Tata McGraw Hill 1992.

CMAACOR06P: Operating Systems Lab **Practical: 60 Lectures**

Unix/Linux Commands & Shell Scripts

Solution of standard problem using shell script

1. WRITE A PROGRAM (using fork() and/or exec() commands) where parent and child execute:
a. same program, same code.
b. same program, different code.
c. before terminating, the parent waits for the child to finish its task.
2. WRITE A PROGRAM to report behaviour of Linux kernel including kernel version, CPU type and model. (CPU information)
3. WRITE A PROGRAM to report behaviour of Linux kernel including information on configured memory, amount of free and used memory. (memory information)
4. WRITE A PROGRAM to print file details including owner access permissions, file access time, where file name is given as argument.
5. WRITE A PROGRAM to copy files using system calls.
6. Write program to implement FCFS scheduling algorithm.

7. Write program to implement Round Robin scheduling algorithm.
8. Write program to implement SJF scheduling algorithm.
9. Write program to implement non-preemptive priority based scheduling algorithm.
10. Write program to implement preemptive priority based scheduling algorithm.
11. Write program to implement SRJF scheduling algorithm.
12. Write program to calculate sum of n numbers using thread library.
13. Write a program to implement first-fit, best-fit and worst-fit allocation strategies.

CMAACOR07T: Discrete Structures **Theory: 75 Lectures**

1. Introduction: **(18 Lectures)**
Sets - finite and Infinite sets, functions, relations, Properties of Binary Relations, Closure, Partial Ordering Relations; counting - Pigeonhole Principle, Permutation and Combination; Mathematical Induction, Principle of Inclusion and Exclusion.

2. Growth of Functions: **(12 Lectures)**
Asymptotic Notations, Summation formulas and properties, Bounding Summations, approximation by Integrals

3. Recurrences: **(15 Lectures)**
Recurrence Relations, generating functions, Linear Recurrence Relations with constant coefficients and their solution, Substitution Method, Characteristics, Master Theorem

4. Graph Theory **(15 Lectures)**
Basic Terminology, Models and Types, multigraphs and weighted graphs, Graph Representation, Graph Isomorphism, Connectivity, Euler and Hamiltonian Paths and Circuits, Planar Graphs (concepts only), Trees, Basic Terminology and properties of Trees, Introduction to Spanning Trees

5. Prepositional Logic **(15 Lectures)**
Logical Connectives, Well-formed Formulas, Tautologies, Equivalences, Inference Theory

Recommended Books:

1. C.L. Liu , D.P. Mahopatra, Elements of Discrete mathematics, 2nd Edition , Tata McGraw Hill, 1985,
2. Kenneth Rosen, Discrete Mathematics and Its Applications, Sixth Edition ,McGraw Hill 2006
3. T.H. Coremen, C.E. Leiserson, R. L. Rivest, Introduction to algorithms, 3rd edition Prentice Hall on India, 2009
4. M. O. Albertson and J. P. Hutchinson, Discrete Mathematics with Algorithms , John wiley Publication, 1988
5. J. L. Hein, Discrete Structures, Logic, and Computability, 3rd Edition, Jones and Bartlett Publishers, 2009
6. D.J. Hunter, Essentials of Discrete Mathematics, Jones and Bartlett Publishers, 2008
7. 7. Graph Theoryby N. Deo, PHI

CMAACOR08T:Multimedia Systems and Internet Technologies **(60 Lectures)**

1: Introduction to Computer Graphics & Graphics Systems **(10 Lectures)**
Overview of computer graphics, representing pictures, preparing, presenting & interacting with pictures for presentations; Visualization & image processing; RGB color model, direct coding, lookup table;

2: Multimedia **(6 Lectures)**
Introduction to Multimedia: Concepts, uses of multimedia, hypertext and hypermedia. Image, video and audio standards.

3: Audio **(6 Lectures)**
digital audio, MIDI, processing sound, sampling, compression.

4: Video **(10Lectures)**
MPEG compression standards, compression through spatial and temporal redundancy, inter-frame and intra-frame compression.

5: Animation **(10Lectures)**
types, techniques, key frame animation, utility, morphing. Virtual Reality concepts.Morphing and tweening

6 : History and Evolution of Web **(18 Lectures)**

Web 1.0 to Web 4.0, Concept of Client Server Architecture, 3-tier Web Architecture, Hyper Text Transfer Protocol (HTTP), File Transfer Protocol (FTP), Web Pages, Domain Names, URL, Internet Protocol Address, Website, Web browser, Web Servers, Web Hosting, Cookies.WWW- basic concepts, web-client & web-server, application server Exploring Web Technologies: HTML, XHTML, DHTML, DOM, XML

CMAACOR08P:Multimedia Systems and Internet Technologies **60 Lectures**

PROGRAM 1 : PROCEDURE TO CREATE AN ANIMATION TO REPRESENT THE GROWING MOON.
PROGRAM 2 : PROCEDURE TO CREATE AN ANIMATION TO INDICATE A BALL BOUNCING ON STEPS.
PROGRAM 3 : PROCEDURE TO SIMULATE MOVEMENT OF A CLOUD.
PROGRAM 4 : PROCEDURE TO DRAW THE FAN BLADES AND TO GIVE PROPER ANIMATION.
PROGRAM 5 : PROCEDURE TO DISPLAY THE BACKGROUND GIVEN (FILENAME: TULIP.JPG) THROUGH YOUR NAME.
PROGRAM 6 : procedure to create an animation with the following features.
WELCOME
*Letters should appear one by one
*The fill colour of The text should change to a different colour after the display of the full word.
PROGRAM 7 : PROCEDURE TO SIMULATE A BALL HITTING ANOTHER BALL.
PROGRAM 8 : PROCEDURE TO CREATE AN ANIMATED CURSOR USING STARTDRAG("SS", TRUE); MOUSE.HIDE();
PROGRAM 9 : PROCEDURE TO DESIGN A VISITING CARD CONTAINING ATLEAST ONE GRAPHIC AND TEXT INFORMATION.
PROGRAM 10 : PROCEDURE TO TAKE A PHOTOGRAPHIC IMAGE. GIVE A TITLE FOR THE IMAGE. PUT THE BORDER. WRITE YOUR NAMES. WRITE THE NAME OF INSTITUTION AND PLACE.
PROGRAM 11 : PROCEDURE TO PREPARE A COVER PAGE FOR THE BOOK IN YOUR SUBJECT AREA. PLAN YOUR OWN DESIGN.
PROGRAM 12 :
PROCEDURE TO EXTRACT THE FLOWER ONLY FROM GIVEN PHOTOGRAPHIC IMAGE AND ORGANISE IT ON A BACKGROUND.
PROGRAM 13 : PROCEDURE TO ADJUST THE BRIGHTNESS AND CONTRAST OF THE PICTURE SO THAT IT GIVES AN ELEGANT LOOK.
PROGRAM 14 : PROCEDURE TO POSITION THE PICTURE PREFERABLY ON A PLAIN BACKGROUND OF A COLOUR OF YOUR CHOICE - POSITIONING INCLUDES ROTATION AND SCALING.
PROGRAM 15 : ROCEDURE TO REMOVE THE ARROWS AND TEXT FROM THE GIVEN PHOTOGRAPHIC IMAGE
PROGRAM 16 : PROCEDURE TO TYPE A WORD AND APPLY THE EFFECTS SHADOW EMBOSS
PROGRAM 17 : PROCEDURE TO USE APPROPRIATE TOOL(S) FROM THE TOOLBOX, CUT THE OBJECTS FROM 3 FILES (F1.JPG, F2.JPG & F3.JPG); ORGANISE THEM IN A SINGLE FILE AND APPLY FEATHER EFFECTS.
PROGRAM 18 : PROCEDURE TO DISPLAY THE BACKGROUND GIVEN (FILENAME: GARDEN.JPG) THROUGH YOUR NAME USING MASK.
PROGRAM 19 : PROCEDURE TO MAKE ANYONE OF ONE OF THE PARROTS BLACK & WHITE IN A GIVEN PICTURE.
PROGRAM 20 : PROCEDURE TO CHANGE A CIRCLE INTO A SQURE USING FLASH.

CMAACOR09T: OOP's using Java **Theory: 60 Lectures**

1. Introduction to Java **(4 Lectures)**

Java Architecture and Features, Understanding the semantic and syntax differences between C and Java, 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),

2. Arrays, Strings and I/O **(8 Lectures)**

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.

3. Object-Oriented Programming Overview (4 Lectures)
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.

4. Inheritance, Interfaces, Packages, Enumerations, Autoboxing and Metadata (14 lectures)
Inheritance: (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.

5. Exception Handling, Threading, Networking and Database Connectivity (15 Lectures)
Exception types, uncaught exceptions, throw, built-in exceptions, Creating your own exceptions; Multi-threading: The Thread class and Runnable interface, creating single and multiple threads, Thread prioritization, synchronization and communication, suspending/resuming threads. Using java.net package, Overview of TCP/IP and Datagram programming. Accessing and manipulating databases using JDBC.

6. Applets and Event Handling (15 Lectures)
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, textfields, layout managers, menus, events and listeners; Graphic objects for drawing figures such as lines, rectangles, ovals, using different fonts. Overview of servlets.

Recommended Books:

1. Ken Arnold, James Gosling, David Homes, "The Java Programming Language", 4th Edition, 2005.
2. James Gosling, Bill Joy, Guy L Steele Jr, GiladBracha, Alex Buckley"The Java Language Specification, Java SE 8 Edition (Java Series)", Published by Addison Wesley, 2014.
3. Joshua Bloch, "Effective Java" 2nd Edition,Publisher: Addison-Wesley, 2008.
4. Cay S. Horstmann, GaryCornell, "Core Java 2 Volume 1 ,9th Edition,Printice Hall.2012
5. Cay S. Horstmann, Gary Cornell, "Core Java 2 Volume 2 - Advanced Features)", 9th Edition, Printice Hall.2013
6. Bruce Eckel, "Thinking in Java", 3rd Edition, PHI, 2002.
7. E. Balaguruswamy, "Programming with Java", 4th Edition, McGraw Hill.2009.
8. Paul Deitel, Harvey Deitel, "Java: How to Program", 10th Edition, Prentice Hall, 2011.
9. "Head First Java", Orielly Media Inc. 2nd Edition, 2005.
10. David J. Eck, "Introduction to Programming Using Java", Published by CreateSpace Independent Publishing Platform, 2009.
11. John R. Hubbard, "Programming with JAVA", Schaum's Series, 2nd Edition, 2004.

CMAACOR09P: Practical: OOP's Using Java 60 Lectures

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 learn use of .lenth in case of a two dimensional array
5. To convert a decimal to binary number
6. To check if a number is prime or not, by taking the number as input from the keyboard
7. 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
8. Write a program that show working of different functions of String and StringBufferclasss like setCharAt(, setLength(), append(), insert(), concat()and equals().
9. 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
10. 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.
11. 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)
12. 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
13. Write a program to show the use of static functions and to pass variable length arguments in a function.
14. Write a program to demonstrate the concept of boxing and unboxing.
15. 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).
16. 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.
17. Write a program that creates illustrates different levels of protection in classes/subclasses belonging to same package or different packages
18. 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.
19. Write a program to show the use of nested try statements that emphasizes the sequence of checking for catch handler statements.
20. 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).
21. Write a program to demonstrate priorities among multiple threads.
22. Write a program to demonstrate multithread communication by implementing synchronization among threads (Hint: you can implement a simple producer and consumer problem).
23. 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.
24. 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.
25. 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.
26. Write a program to get the URL/location of code (i.e. java code) and document(i.e. html file).
27. Write a program to demonstrate different mouse handling events like mouseClicked(), mouseEntered(), mouseExited(), mousePressed, mouseReleased() and mouseDragged().
28. Write a program to demonstrate different keyboard handling events.
29. Write a program to generate a window without an applet window using main() function.
30. Write a program to demonstrate the use of push buttons.

CMAACOR10T: Software Engineering **Theory:75 Lectures**

1.Introduction **(15 Lectures)**
The Evolving Role of Software, Software Characteristics, Changing Nature of Software, Software Engineering as a Layered Technology, Software Process Framework, Framework and Umbrella Activities, Process Models, Capability Maturity Model Integration (CMMI).

2.Requirement Analysis **(14 Lectures)**
Software Requirement Analysis, Initiating Requirement Engineering Process, Requirement Analysis and Modeling Techniques, Flow Oriented Modeling, Need for SRS, Characteristics and Components of SRS.

3.Software Project Management **(10Lectures)**
Estimation in Project Planning Process, Project Scheduling.

4.Quality Management **(10 Lectures)**
Quality Concepts, Software Quality Assurance, Software Reviews, Metrics for Process and Projects.

5.Design Engineering **(12 Lectures)**
Design Concepts, Architectural
Design Elements, Software Architecture, Data Design at the Architectural Level and Component Level, Mapping of Data

Flow into Software Architecture, Modeling Component Level Design.

6.Testing Strategies & Tactics **(14 Lectures)**

Software Testing Fundamentals, Strategic Approach to Software Testing, Test Strategies for Conventional Software, Validation Testing, System testing, Black-Box Testing, White-Box Testing and their type, Basis Path Testing.

Recommended Books:

1. R.S. Pressman, Software Engineering: A Practitioner's Approach (7th Edition), McGraw-Hill, 2009.
2. P. Jalote, An Integrated Approach to Software Engineering (2nd Edition), Narosa Publishing House, 2003.
3. K.K. Aggarwal and Y. Singh, Software Engineering (2nd Edition), New Age International Publishers, 2008.
4. I. Sommerville, Software Engineering (8th edition), Addison Wesley, 2006.
5. D. Bell, Software Engineering for Students (4th Edition), Addison-Wesley, 2005.
6. R. Mall, Fundamentals of Software Engineering (2nd Edition), Prentice-Hall of India, 2004.

CMAACOR11T: Artificial Intelligence **Theory: 60 Lectures**

1. Introduction **(10 Lectures)**

Introduction to Artificial Intelligence, Background and Applications, Turing Test and Rational Agent approaches to AI, Introduction to Intelligent Agents, their structure, behavior and environment.

2. Problem Solving and Searching Techniques **(20 Lectures)**

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.

3. Knowledge Representation **(20 Lectures)**

Introduction to First Order Predicate Logic, Resolution Principle, Unification, Semantic Nets, Conceptual Dependencies, Frames, and Scripts, Production Rules, Conceptual Graphs.
Programming in Logic (PROLOG)

4. Understanding Natural Languages **(10 Lectures)**

Parsing Techniques, Context-Free and Transformational Grammars, Recursive and Augmented Transition Nets.

Recommended Books:

1. DAN.W. Patterson, Introduction to A.I and Expert Systems – PHI, 2007.
2. Russell &Norvig, Artificial Intelligence-A Modern Approach, LPE, Pearson Prentice Hall, 2nd edition, 2005.
3. Rich & Knight, Artificial Intelligence – Tata McGraw Hill, 2nd edition, 1991.
4. W.F. Clocksin and Mellish, Programming in PROLOG, Narosa Publishing House, 3rd edition, 2001.
5. Ivan Bratko, Prolog Programming for Artificial Intelligence, Addison-Wesley, Pearson Education, 3rd edition, 2000.

CMAACOR11P: Artificial Intelligence Lab **Practical: 60 Lectures**

1. Write a prolog program to calculate the sum of two numbers.
2. Write a prolog program to find the maximum of two numbers.
3. Write a prolog program to calculate the factorial of a given number.
4. Write a prolog program to calculate the nth Fibonacci number.
5. Write a prolog program, insert_nth(item, n, into_list, result) that asserts that result is the list into_list with item inserted as the n'th element into every list at all levels.
6. Write a Prolog program to remove the Nth item from a list.
7. Write a Prolog program, remove-nth(Before, After) that asserts the After list is the Before list with the removal of every n'th item from every list at all levels.
8. Write a Prolog program to implement append for two lists.
9. Write a Prolog program to implement palindrome (List).
10. Write a Prolog program to implement max(X,Y,Max) so that Max is the greater of two numbers X and Y.
11. Write a Prolog program to implement maxlist(List,Max) so that Max is the greatest number in the list of numbers List.
12. Write a Prolog program to implement sumlist(List,Sum) so that Sum is the sum of a given list of numbers List.

13. Write a Prolog program to implement two predicates evenlength(List) and oddlength(List) so that they are true if their argument is a list of even or odd length respectively.
14. Write a Prolog program to implement reverse(List,ReversedList) that reverses lists.
15. Write a Prolog program to implement maxlist(List,Max) so that Max is the greatest number in the list of numbers List using cut predicate.
16. Write a Prolog program to implement GCD of two numbers.
17. Write a prolog program that implements Semantic Networks/Frame Structures.

CMAACOR12T: Computer Networks **Theory: 75 Lectures**

1. Introduction to Computer Networks **(8 Lectures)**
Network definition; network topologies; network classifications; network protocol; layered network architecture; overview of OSI reference model; overview of TCP/IP protocol suite.

2. Data Communication Fundamentals and Techniques **(12 Lectures)**
Analog and digital signal; data-ratelimits; digital to digital line encoding schemes; pulse code modulation; parallel and serial transmission; digital to analog modulation-; multiplexing techniques- FDM, TDM; transmission media.

3. Networks Switching Techniques and Access mechanisms **(12 Lectures)**
Circuit switching; packet switching- connectionless datagram switching, connection-oriented virtual circuit switching; dial-up modems; digital subscriber line; cable TV for data transfer.

4. Data Link Layer Functions and Protocol **(12 Lectures)**
Error detection and error correction techniques; data-link control- framing and flow control; error recovery protocols- stop and wait ARQ, go-back-n ARQ; Point to Point Protocol on Internet.

5. Multiple Access Protocol and Networks **(5 Lectures)**
CSMA/CD protocols; Ethernet LANS; connecting LAN and back-bone networks- repeaters, hubs, switches, bridges, router and gateways;

6. Networks Layer Functions and Protocols **(12 Lectures)**
Routing; routing algorithms; network layer protocol of Internet- IP protocol, Internet control protocols.

7. Transport Layer Functions and Protocols **(8 Lectures)**
Transport services- error and flow control, Connection establishment and release- three way handshake;

8. Overview of Application layer protocol **(6 Lectures)**
Overview of DNS protocol; overview of WWW &HTTP protocol.

Recommended Books:

1. B. A. Forouzan: Data Communications and Networking, Fourth edition, THM, 2007.
2. A.S. Tanenbaum: Computer Networks, Fourth edition, PHI, 2002

CMAACOR13T: Design and Analysis of Algorithms Lab Theory **60 Lectures**

1. Introduction **(5 Lectures)**
Asymptomatic notation, Master Theoram Basic Design and Analysis techniques of Algorithms, Correctness of Algorithm.

2. Algorithm Design Techniques **(13 Lectures)**
Iterative techniques, Divide and Conquer, Dynamic Programming, Greedy Algorithms. Branch and bound, Backtracking, Basic methods and example.

3. Sorting and Searching Techniques **(20 Lectures)**
Fundamental concepts of sorting techniques, Internal & external Sorting–Bubble Sort, Insertion Sort, Merge Sort, Advanced Sorting techniques - Heap Sort, Quick Sort, Sorting in Linear Time t, Radix Sort and Count Sort, Searching Techniques,

complexity analysis;

4. Lower Bounding Techniques **(5 Lectures)**
Decision Trees

5. Balanced Trees **(7 Lectures)**
Red-Black Trees

7. Graphs **(5 Lectures)**
Graph Algorithms–Breadth First Search, Depth First Search and its Applications, Minimum Spanning Trees.

8. String Processing **(5Lectures)**
String Matching, KMP Technique

Recommended Books:

1. T.H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein Introduction to Algorithms, PHI, 3rd Edition 2009
2. Sarabasse& A.V. Gelder Computer Algorithm – Introduction to Design and Analysis, Publisher – Pearson 3rd Edition 1999
3. Horowitz and Sahani, Fundamentals of Computer Algorithms, 2ND Edition
4. Brassard And Bratley Fundamentals Of Algorithmics, EEE

CMAACOR13P: Design and Analysis of Algorithms Lab **Practical: 60 Lectures**

1. i. Implement Insertion Sort (The program should report the number of comparisons)
   ii.Implement Merge Sort(The program should report the number of comparisons)
2. Implement Heap Sort(The program should report the number of comparisons)
3. Implement Randomized Quick sort (The program should report the number of comparisons)
4. Implement Radix Sort
5. Create a Red-Black Tree and perform following operations on it:
   i. Insert a node
   ii. Delete a node
   iii. Search for a number & also report the color of the node containing this number.
6. Write a program to determine the LCS of two given sequences
7. Implement Breadth-First Search in a graph
8. Implement Depth-First Search in a graph
9. Write a program to determine the minimum spanning tree of a graph

For the algorithms at S.No 1 to 3 test run the algorithm on 100 different inputs of sizes varying from 30 to 1000. Count the number of comparisons and draw the graph. Compare it with a graph of nlogn.

CMAACOR14T: Theory of Computation **Theory: 75 Lectures**

1. Languages **(10 Lectures)**
Alphabets, string, language, Basic Operations on language, Concatenation, Kleene Star

2. Finite Automata and Regular Languages **(25 Lectures)**
Regular Expressions, Transition Graphs, Deterministics and non-deterministic finite automata, NFA to DFA Conversion, Regular languages and their relationship with finite automata, closure properties of regular languages.

3. Context free languages **(30 Lectures)**
Context free grammars, parse trees, ambiguities in grammars and languages, Pushdown automata grammer, types of grammer. Regular grammer CNF, Equivalence of DFA, NDFA, RE & RG.

4. Turing Machines and Models of Computations **(10 Lectures)**
Turing Machine as a model of computation, Universal Turing Machine, Language acceptability,

Recommended Books:

1. Theory of Computer Science by Mishra & Chandreshekharan, PHI
2. Hoperoft, Aho, Ullman, Introduction to Automata theory, Language & Computation –3rd Edition, Pearson Education. 2006
3. P. Linz, An Introduction to Formal Language and Automata 4th edition Publication Jones Bartlett, 2006

Discipline Specific Elective Papers COMPUTER SCIENCE: (Credit: 06 each) (4 papers to be selected) – DSE 1 - 4

CMAADSE01T: Introduction to Data Science **Theory:60 Lectures**

1. Data Scientist's Tool Box **(10 Lectures)**
Turning data into actionable knowledge, introduction to the tools that will be used in building data analysis software: version control, markdown, git, GitHub, R, and Rstudio

2. Basics of R Programming in respect to Data Science **(15 Lectures)**
Overview of R, R data types and objects, reading and writing data, Control structures, functions, scoping rules, dates and times, Loop functions, debugging tools, Simulation, code profiling

3. Getting and Cleaning Data **(15 Lectures)**
Obtaining data from the web, from APIs, from databases and from colleagues in various formats, basics of data cleaning and making data ―tidy

4. Exploratory Data Analysis **(10 Lectures)**
Essential exploratory techniques for summarizing data, applied before formal modeling commences, eliminating or sharpening potential hypotheses about the world that can be addressed by the data, common multivariate statistical techniques used to visualize high-dimensional data.

5. Reproducible Computing **(10 Lectures)**
Concepts and tools behind reporting modern data analyses in a reproducible manner, To write a document using R markdown, integrate live R code into a literate statistical program, compile R markdown documents using knitr and related tools, and organize a data analysis so that it is reproducible and accessible to others.

Recommended Books:

1. D. Cielen, Arno D. B. Meysman, M. Ali, Introducing Data Science, Dreamtech Press
2. Rachel Schutt, Cathy O'Neil, "Doing Data Science: Straight Talk from the Frontiline" by Schroff/O'Reilly, 2013.
3. Foster Provost, Tom Fawcett, "Data Science for Business" What You Need to Know About Data Mining and Data-Analytic Thinking" by O'Reilly, 2013.
Syllabus of BCA (Honours) under CBCS
464. John W. Foreman, "Data Smart: Using data Science to Transform Information into Insight" by John Wiley & Sons, 2013.
5. Ian Ayres, "Super Crunchers: Why Thinking-by-Numbers Is the New Way to Be Smart" Ist Edition by Bantam, 2007.
6. Eric Seigel, "Predictive Analytics: The Power to Predict who Will Click, Buy, Lie, or Die", 1st Edition, by Wiley, 2013.
7. Matthew A. Russel, "Mining the Social Web: Data mining Facebook, Twitter, Linkedln, Goole+, GitHub, and More", Second Edition, by O'Reilly Media, 2013.
8. Michael J. Crawley, The R Book, Wiley

CMAADSE01P: Introduction to Data Science PRACTICAL **60 Lectures**

Students are advised to do laboratory/practical practice not limited to, but including the following types of problems:
1. Write a program that prints „Hello World„ to the screen.
2. Write a program that asks the user for a number n and prints the sum of the numbers 1 to n
3. Write a program that prints a multiplication table for numbers up to 12.
4. Write a function that returns the largest element in a list.
5. Write a function that computes the running total of a list.
6. Write a function that tests whether a string is a palindrome.
7. Implement linear search.
8. Implement binary search.

9. Implement matrices addition , subtraction and Multiplication
10. Fifteen students were enrolled in a course. There ages were:
20 20 20 20 20 21 21 21 22 22 22 22 23 23 23
a. Find the median age of all students under 22 years
b. Find the median age of all students
c. Find the mean age of all students
d. Find the modal age for all students
e. Two more students enter the class. The age of both students is 23. What is now mean, mode and median?
11. Following table gives a frequency distribution of systolic blood pressure. Compute all the measures of dispersio

Midpoint	95.5	105.5	115.5	125.5	135.5	145.5	155.5	165.5	175.5
Number	5	8	22	27	17	9	5	5	2

12. Obtain probability distribution of, where X is number of spots showing when a six-sided symmetric die (i.e. all six faces of the die are equally likely) is rolled. Simulate random samples of sizes 40, 70 and 100 respectively and verify the frequency interpretation of probability.
13. Make visual representations of data using the base, lattice, and ggplot2 plotting systems in R, apply basic principles of data graphics to create rich analytic graphics from available datasets.
14. Use Git / Github software to create Github account. Also, create a repo using Github.

CMAADSE02T: VISUAL PROGRAMMING **Theory:60 Lectures**

1. Introduction to Visual Programming **(10 Lectures)**
Need for Visual Programming, Advantages and Disadvantages of Visual Programming, Event based programming, Introduction to Visual Basic, Visual Basic Editions, Writing Visual Basic Projects,

2. Visual Programming Controls **(10 Lectures)**
Positioning of Controls, Coding with Controls, Code writing mechanics, understanding numbering systems, Coding for controls, focus, setting tab orders.

3. Visual Programming Objects **(10 Lectures)**
coding basics, use of variables and literals, declaring variables, storing and retrieving data in variables, use of constants and operators, creating your own constants, arithmetic operators and expressions, logical operators

4. Introduction Control Structures **(10 Lectures)**
Decision structure, and introduction to looping constructs

5. Arrays **(20 Lectures)**
Types of arrays, adding controls at run time, menus, designing a menu, attaching code to menus, introduction to procedures, event procedures, working with procedures, multiple forms, standard code modules.

Recommended Books:

1. Professional Visual Studio 2017, Bruce Johnson.
2. Programming with MS Visual Basic 2015, Diane Zak.
3. Beginning Visual Basic 2015, Bryan Newsome.
4. Programming in Visual Basic, McBride.
5. Programming in Visual Basic 6, Ivan Bayross.
6. Programming In Microsoft Visual Basic 6.0, Saini and Sharma.
7. Programming in Visual Basic 2010: The Very Beginner's Guide, Jim McKeown

CMAADSE02P – VISUAL PROGRAMMING PRACTICAL **TOTAL-60 Lectures**
1. GUI Environment: (4L)
Introduction to graphical user interface (GUI), programming. Language (procedural, object oriented, event driven), the GUI environment, compiling, debugging, and running the programs.
2. Controls : (8L)
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.

3. Operations: (2L)
Data types, constants, named & intrinsic, declaring variables, scope of variables, val function, arithmetic operations, formatting data.
4. Decision Making : (4L)
If statement, comparing strings, compound conditions (and, or, 4L 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.
5. Modular programming: (8L)
Menus, sub-procedures and sub-functions defining / 8L creating and modifying a menu, using common dialog box, creating a new subprocedure, passing variables to procedures, passing argument by value or by reference, writing a function/ procedure.
6. Forms Handling : (6L)
Multiple forms creating, adding, removing forms in project, hide, 6L show method, load, unload statement, me keyword, referring to objects on a different forms
7. Iteration Handling: (6L)
Do/loops, for/next loops, using msgbox function, using string function
8. Arrays and Grouped Data Control: (4L)
Arrays - 1-dimension arrays, initializing an 6L array using for each, user-defined data types, accessing information with user-defined data types, using list boxes with array, two dimensional arrays. lists, loops and printing list boxes & combo boxes, filling the list using property window / additem method, clear method, list box properties, removing an item from a list, list box/ combo box operations.
9. Database Connectivity: (10L)
Database connectivity of forms with back end tool like mysql, populating the data in text boxes, list boxes etc. searching of data in database using forms. Updating/ editing of data based on a criterion.

10. Data Report Generation (8L)

Recommended Books:

1. Professional Visual Studio 2017, Bruce Johnson.
2. Programming with MS Visual Basic 2015, Diane Zak.
3. Beginning Visual Basic 2015, Bryan Newsome.
4. Programming in Visual Basic, McBride.
5. Programming in Visual Basic 6, Ivan Bayross.
6. Programming In Microsoft Visual Basic 6.0, Saini and Sharma.
7. Programming in Visual Basic 2010: The Very Beginner's Guide, Jim McKeown

CMAADSE03T: Data Mining **Theory: 60 lectures**

1. Introduction **(6 Lectures)**
Basic Data Mining Tasks, Data Mining Issues, Data Mining Metrics, Data Mining from a Database Perspective

2. Data Mining Techniques **(10 Lectures)**
A Statistical Perspective on Data Mining, Similarity Measures, Decision Trees, Neural Networks, Genetic Algorithms

3. Classification **(15 Lectures)**
Statistical-Based Algorithms, Distance-Based Algorithms, Decision Tree-Based Algorithms, Neural Network-Based Algorithms, Rule-Based Algorithms, Combining Techniques.

4. Clustering **(12 Lectures)**
Similarity and Distance Measures, Hierarchical Algorithms, Partitional Algorithms, Clustering Large Databases, Clustering with Categorical Attributes

5. Association Rules **(12 Lectures)**
Basic Algorithms, Parallel and Distributed Algorithms, Incremental Rules, Advanced Association Rule Techniques, Measuring the Quality of Rules.

6. Advanced Techniques **(5 Lectures)**
Web Mining, Spatial Mining, Temporal Mining.

Recommended Books:

1. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Introduction to Data Mining, Pearson Education.2005.
2. Richard Roiger, Michael Geatz, Data Mining: A Tutorial Based Primer, Pearson Education 2003.
3. G.K. Gupta, Introduction to Data Mining with Case Studies, PHI,2006.
4. Soman K P, Diwakar Shyam, Ajay V Insight Into Data Mining: Theory And Practice, , PHI, 2006
5. Data Mining Techniques, Arun Pujari, Fourth Edition, University Press

CMAADSE03P: Data Mining Lab **Practical: 60 lectures**

Practical exercises based on concepts listed in theory.

CMAADSE04T: Information Security & Cyber Law **Theory: 75 lectures**

1. Introduction to the concept of Information Security **(10 Lectures)**
Need for Security, Security approaches, Principles of Security, Types of Attack.

2. Key Elements of ISM Framework **(5 Lectures)**
Control, Planning, Evaluation, Implementation, Maintenance, Prevention, Reduction, Detection, Repression, Correction

3. Introduction to Cyber Law **(15 Lectures)**
Objective, Emerging Trends, Cyberspace, Cyber Security awareness and its policies

4. Cyber Crime, Nature of Threats, IT Act **(15 Lectures)**

5. Itellectual Property Rights, Cyber Security Strategies **(10 Lectures)**

6. Policies to mitigate cyber risk, Network Security **(10 Lectures)**

7. Digital and Electronic Signatures, Offences and penalties **(10 Lectures)**

CMAADSE05T: Cloud Computing **Theory: 60 lectures**

1.Overview of Computing Paradigm **(8 Lectures)**
Recent trends in Computing : Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing,

2.Introduction to Cloud Computing **(7 Lectures)**
Introduction to Cloud Computing, History of Cloud Computing, Cloud service providers, Benefits and limitations of Cloud Computing,

3.Cloud Computing Architecture **(20 Lectures)**
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.

4.Case Studies **(13 Lectures)**
Case study of Service model using Google App Engine, Microsoft Azure, Amazon EC2 , Eucalyptus.

5.Service Management in Cloud Computing **(7 Lectures)**
Service Level Agreements(SLAs), Billing & Accounting, Comparing Scaling Hardware: Traditional vs. Cloud, Economics of scaling.

6.Cloud Security **(5 Lectures)**
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.

Recommended Books:

1. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010.
2. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wile, 2011.
3. Cloud Computing: Principles, Systems and Applications, Editors: Nikos Antonopoulos, Lee Gillam, Springer, 2012.
4. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India, 2010.
5. Gautam Shroff, Enterprise Cloud Computing Technology Architecture Applications , Adobe Reader ebooks available from eBooks.com,2010.
6. Toby Velte, Anthony Velte, Robert Elsenpeter, Cloud Computing, A Practical Approach ,McGraw Hills, 2010.
7. Dimitris N. Chorafas, Cloud Computing Strategies ,CRC Press, 2010.

CMAADSE05P: Cloud Computing Lab **60 Lectures**

1. Create virtual machines that access different programs on same platform.
2. Create virtual machines that access different programs on different platforms .
3. Working on tools used in cloud computing online-
a. Storage
b. Sharing of data
c. manage your calendar, to-do lists,
d. a document editing tool
4. Exploring Google cloud
5. Exploring microsoft cloud
6. Exploring amazon cloud

CMAADSE06P: Discipline Specific Elective: Dissertation / Project Work

This option 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.

Skill Enhancement Courses (any two) (Credit: 02 each) – SEC1 to SEC2 Theory: 01, Labs: 02

CMSSSEC001: Programming in Python **Theory:15 Lectures**

1.Planning the Computer Program: **(2 Lectures)**
Concept of problem solving, Problem definition, Program design, Debugging, Types of errors in programming, Documentation.

2.Techniques of Problem Solving **(2 Lectures)**
Flowcharting, decision table, algorithms, Structured programming concepts, Programming methodologies viz. top-down and bottom-up programming.

3.Overview of Programming **(3 Lectures)**
Structure of a Python Program, Elements of Python

4.Introduction to Python **(4 Lectures)**
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, Increment or Decrement operator).

5.Creating Python Programs **(4 Lectures)**

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

Recommended Books:

1. T. Budd, Exploring Python, TMH, 1st Ed, 2011
2. Python Tutorial/Documentation www.python.or 2015
3. Allen Downey, Jeffrey Elkner, Chris Meyers , How to think like a computer scientist : learning with Python, Freely available online.2012
4. http://docs.python.org/3/tutorial/index.html
5. http://interactivepython.org/courselib/static/pythonds
6. http://www.ibiblio.org/g2swap/byteofpython/read/

Software Lab Based on Python:

Section: A (Simple programs)

1. Write a menu driven program to convert the given temperature from Fahrenheit to Celsius and vice versa depending upon users choice.
2. WAP to calculate total marks, percentage and grade of a student. Marks obtained in each of the three subjects are to be input by the user. Assign grades according to the following criteria :
Grade A: Percentage >=80
Grade B: Percentage>=70 and <80 Grade C: Percentage>=60 and <70 Grade D: Percentage>=40 and <60 Grade E: Percentage<40
3. Write a menu-driven program, using user-defined functions to find the area of rectangle, square, circle and triangle by accepting suitable input paramters from user.
4. WAP to display the first n terms of Fibonacci series.
5. WAP to find factorial of the given number.
6. WAP to find sum of the following series for n terms: 1 – 2/2! + 3/3! - - - - - n/n!
7. WAP to calculate the sum and product of two compatible matrices.

Section: B (Visual Python):

All the programs should be written using user defined functions, wherever possible.
1. Write a menu-driven program to create mathematical 3D objects I. curve
II. sphere
III. cone IV. arrow
V. ring
VI. cylinder.
2. WAP to read n integers and display them as a histogram.
3. WAP to display sine, cosine, polynomial and exponential curves.

4. WAP to plot a graph of people with pulse rate p vs. height h. The values of p and h are to be entered by the user.
5. WAP to calculate the mass m in a chemical reaction. The mass m (in gms) disintegrates according to the formula m=60/(t+2), where t is the time in hours. Sketch a graph for t vs. m, where t>=0.
6. A population of 1000 bacteria is introduced into a nutrient medium. The population p grows as follows:
P(t) = (15000(1+t))/(15+ e)
where the time t is measured in hours. WAP to determine the size of the population at given time t and plot a graph for P vs t for the specified time interval.

7. Input initial velocity and acceleration, and plot the following graphs depicting equations of motion:
I. velocity wrt time (v=u+at)
II. distance wrt time (s=u*t+0.5*a*t*t)

III. distance wrt velocity (s=(v*v-u*u)/2*a)
8. WAP to show a ball bouncing between 2 walls. (Optional)

CMSSSEC002: R-Programming (1+2 Labs) **Theory:15 Lectures**

(5 Lectures)

Overview and History of R, Getting Help, Data Types, Subsetting, Vectorized Operations, Reading and Writing Data.

Control Structures, Functions, lapply, tapply, split, mapply, apply, Coding Standards. **(5 Lectures)**

Scoping Rules, Debugging Tools, Simulation, R Profiler. **(5 Lectures)**

Recommended Books:

1. William N. Venables and David M. Smith, An Introduction to R. 2nd Edition. Network Theory Limited.2009
2. Norman Matloff, The Art of R Programming - A Tour of Statistical Software Design, No Starch Press.2011

Software Lab Based on R Programming

1. Write a program that prints _Hello World‘ to the screen.
2. Write a program that asks the user for a number n and prints the sum of the numbers 1 to n
3. Write a program that prints a multiplication table for numbers up to 12.
4. Write a function that returns the largest element in a list.
5. Write a function that computes the running total of a list.
6. Write a function that tests whether a string is a palindrome.
7. Implement the following sorting algorithms: Selection sort, Insertion sort, Bubble Sort
8. Implement linear search.
9. Implement binary search.
10. Implement matrices addition, subtraction and Multiplication