BENGALURU CITY UNIVERSITY

CHOICE BASED CREDIT SYSTEM

(Semester Scheme with Multiple Entry and Exit Options for Under Graduate Course)

Syllabus for B.Sc Computer Science
(I & II Semester)

2021-22 onwards

BANGALORE CITY UNIVERISTY

Proceeding of the meeting of the Board of Studies in Computer Science, held in the Board Room of Canara Bank School of Management Studies, Central College Campus, Bangalore City University, Bangalore on 04-10-2021 at 11.00 am

The Following Members were present:
1. Dr. Susesha, Professor, PG Department of Computer Science, Mysore Univeristy
2. Dr. Chandrakanth Naikodi, Associate Professor, PG Department of Computer Science, Davanagere University
3. Dr. H.K. Gundurao, Associate Professor, Vijaya College, Bangalore
4. Dr. Prathibha V Kalburgi, Ramaiah College of Arts Science, and Commerce, Bangalore
5. Mrs. Amalorpavam, Sambram Academi of Management Studies, Bangalore
6. Dr. Muralidhara B L, Professor, Department of Computer Science, Bangalore University

The Following Member was present online
1. Dr. Guru D.S, Professor, PG Department of Computer Science, Mysore Univeristy

The Following member is diseased
1. Late. Malathi Palani. A

The Following Members did not attend the meeting:
1. Dr. Prabhakar C.J, Professor, Kuvempu University, Shimogga
2. Dr. Bhagyawana S Mudigowda, Associate Professor, Maharani Cluster University
3. Smt. Nagarathnamma S.M, Associate Professor, Maharani Cluster Univeristy

The Chairperson welcomed the members and briefed the members on the proposed syllabus. The Committee discussed the syllabus in detail and approved the following syllabus:
1. III and IV semester syllabus for the MCA CBCS Scheme
2. The syllabus for I to IV semesters syllabus for M.Sc (Computer Science) - CBCS Scheme
3. Syllabus Structure for the NEP BCA, and I, and II semester syllabus for the same
4. Syllabus Structure for the NEP B.Sc Computer Science, and I and II semester syllabus for the same
5. Electives for the CBCS BCA Syllabus

The Chairperson thanked all the members for their active participation.

(Dr. Susesha)   (Dr. Chandrakanth Naikodi)   (Dr. H.K. Gundurao)

(Mrs. Prathibha V Kalburgi)   (Mrs. Amalorpavam)

(Dr. Muralidhara B L) 04.10.2021
Chairperson

MEMBERS OF THE BoS IN COMPUTER SCIENCE

1	Dr. Muralidhara B L Professor Department of Computer Science Bangalore University	CHAIRPERSON
2	Dr. Guru D.S Professor PG Department of Computer Science Mysore Univeristy	Member
3	Dr. Susesha Professor, PG Department of Computer Science Mysore Univeristy	Member
4	Dr. Prabhakar C.J Professor Kuvempu University, Shimogga	Member
5	Dr. Chandrakanth Naikodi Associate Professor Department of Computer Science Davanagere University	Member
6	Dr. Prathibha V Kalburgi Ramaiah College of Arts Science, and Commerce Bangalore	Member
7	Mrs. Amalorpavam Sambram Academi of Management Studies Bangalore	Member
8	Dr. H.K. Gundurao Associate Professor Vijaya College, Bangalore	Member
9	Dr. Bhagyawana S Mudigowda Associate Professor Maharani Cluster University, Bangalore	Member
10	Smt. Nagarathnamma S.M Associate Professor Maharani Cluster Univeristy, Bangalore	Member

BANGALORE CITY UNIVERSITY
PROPOSED BSc Computer Science MAJOR SYLLABUS (NEP)
[Based on IIA Model of Karnataka State Higher Education Council]

Semester	Course Code	Title of the Paper	Credits	Languages, Skill Enhancement (SEC), and Ability Enhancement Courses (AECC)	Credits	Total Credits
I	CS-C1T	Problem Solving Techniques	4	OE1: Open Elective	3	25
	CS-C2P	Problem Solving Lab using C HLL	2	Language L1	3	
	XX	Other Option Theory	4	Language L2	3	
	XX	Other Option LAB	2	SEC I :	2	
				Physical Education	1	
				Health & Wellness	1	
II	CS-C3T	Data Structure	4	OE2: Open Elective	3	25
	CS-C4P	Data Structures Lab	2	Language L1	3	
	XX	Other Option Theory	4	Language L2	3	
	XX	Other Option LAB	2	Environmental Science	2	
				Physical Education	1	
				NCC/NSS/CL/R&R	1	
III	CS-C5T	Object Oriented Programming using Java	4	OE3: Open Elective	3	25
	CS-C6P	Java Lab	2	Language L1	3	
	XX	Other Option Theory	4	Language L2	3	
	XX	Other Option LAB	2	SEC II :	2	
				Physical Education	1	
				NCC/NSS/CL/R&R	1	
IV	CS-C7T	Operating Systems	4	OE4: Open Elective	3	25
	CS-C8P	Linux Lab	2	Language L1	3	
	XX	Other Option Theory	4	Language L2	3	
	XX	Other Option LAB	2	The Constitution of India	2	
				Physical Education	1	
				NCC/NSS/CL/R&R	1	
V	CS-C9T	Database Management System	3	Vocation Course I : Other Option (Major)	3	22
	CS-C10T	Artificial Intelligence	2	SEC III :	2	
	CS-C11P	Database Management System Lab	3	Physical Education	1	
	CS-C12P	Artificial Intelligence Lab	2	NCC/NSS/CL/R&R	1	
	XX	Other Option (Minor) LAB	3			
	XX	Other Option (Minor) LAB	2			

Semester	Course Code	Title of the Paper	Credits	Languages, Skill Enhancement (SEC), and Ability Enhancement Courses (AECC)	Credits	Total Credits
VI	CS-C13T	Python Programming	3	Vocation Course I : Technical Writing	3	24
	CS-C14T	Computer Networks	3	Internship	2	
	CS-C15P	Python Programming Lab	2	SEC III :	2	
	CS-C16P	Computer Networks Lab	2	Physical Education	1	
	XX	Other Option (Minor) Theory	3	NCC/NSS/CL/R&R	1	
	XX	Other Option (Minor) LAB	2			
VII	CS-C17T	Internet Technologies	3	Elective I: (Internet of Things, Cloud Computing, Data Mining, Image Processing, Discrete Structures, Modeling and Simulation)	3	22
	CS-C18T	Data Analytics	3	Elective II : (Internet of Things, Cloud Computing, Data Mining, Image Processing, Discrete Structures, Modeling and Simulation)	3	
	CS-C19T	Design and Analysis of Algorithm	3	Research Methodology	3	
	CS-C20P	Internet Technologies Lab	2			
	CS-C21P	Data Analytics Lab	2			
VIII	CA-C22T	Machine Learning	3	Elective III : (Block Chain Technologies, Operations Research, Human Computer Interface, Parallel Algorithms)	3	20
	CA-C23T	Theory of Computation	3	Research Project	6	
	CA-C24T	System Security	3			
	CA-C24P	Machine Learning Lab	2			

BANGALORE CITY UNIVERSITY
PROPOSED B.Sc Syllabus - Computer Science as a MINOR Subject
(NEP, 2020)

Semester	Course Code	Title of the Paper	Credits	Languages, Skill Enhancement (SEC), and Ability Enhancement Courses (AECC)	Credits	Total Credits
I	CS-C1T	Problem Solving Techniques	4	OE1: Open Elective	3	25
	CS-C2P	Problem Solving Lab using C HLL	2	Language L1	3	
	XX	Other Option Theory	4	Language L2	3	
	XX	Other Option LAB	2	SEC I :	2	
				Physical Education	1	
				Health & Wellness	1	
II	CS-C3T	Data Structure	4	OE2: Open Elective	3	25
	CS-C4P	Data Structures Lab	2	Language L1	3	
	XX	Other Option Theory	4	Language L2	3	
	XX	Other Option LAB	2	Environmental Science	2	
				Physical Education	1	
				NCC/NSS/CL/R&R	1	
III	CS-C5T	Object Oriented Programming using Java	4	OE3: Open Elective	3	25
	CS-C6P	Java Lab	2	Language L1	3	
	XX	Other Option Theory	4	Language L2	3	
	XX	Other Option LAB	2	SEC II :	2	
				Physical Education	1	
				NCC/NSS/CL/R&R	1	
IV	CS-C7T	Operating Systems	4	OE4: Open Elective	3	25
	CS-C8P	UNIX Lab	2	Language L1	3	
	XX	Other Option Theory	4	Language L2	3	
	XX	Other Option LAB	2	The Constitution of India	2	
				Physical Education	1	
				NCC/NSS/CL/R&R	1	
V	CS-C9T	Database Management System	3	Vocation Course I : Computer Animation	3	22
	xx	Other Option (Major) Theory	3	SEC III :	2	
	xx	Other Option (Major) Theory	3	Physical Education	1	
	CS-C10P	Database Management System Lab	2	NCC/NSS/CL/R&R	1	
	XX	Other Option (Major) Practicals	2			
	XX	Other Option (Major) Practicals	2			

Semester	Course Code	Title of the Paper	Credits	Languages, Skill Enhancement (SEC), and Ability Enhancement Courses (AECC)	Credits	Total Credits
VI	CS-C11T	Computer Networks	3	Vocation Course I : Other Option (Major)	3	24
	CS-C12P	Computer Networks Lab	2	Internship	2	
	XX	Other Option (Major) Theory	3	SEC III :	2	
	XX	Other Option (Major) Theory	3	Physical Education	1	
	XX	Other Option (Major) LAB	2	NCC/NSS/CL/R&R	1	
	XX	Other Option (Major) LAB	2			
VII	XX	Other Option (Major) Theory	3	Elective I: Other Option (Major)	3	22
	XX	Other Option (Major) Theory	3	Elective II : Other Option (Major)	3	
	XX	Other Option (Major) Theory	3	Research Methodology	3	
	XX	Other Option (Major) LAB	2			
	XX	Other Option (Major) LAB	2			
VIII	XX	Other Option (Major) Theory	3	Elective III : Other Option (Major)	3	20
	XX	Other Option (Major) Theory	3	Research Project	6	
	XX	Other Option (Major) Theory	3			
	XX	Other Option (Major) LAB	2			

CS-C1T - PROBLEM SOLVING TECHNIQUES

Total Teaching Hours: 64   No. of Hours / Week: 04

UNIT - I   [16 Hours]
Introduction: The Role of Algorithms in Computing, Algorithms as a technology, Analyzing algorithms, Designing algorithms, Growth of Functions, Asymptotic notation, Standard notations and common functions. Fundamental Algorithms: Exchanging the values of two variables, Counting, Summation of a set of numbers, Factorial Computation, Generating of the Fibonacci sequence, Reversing the digits of an integer, Base Conversion, Character to number conversion.

UNIT - II   [16 Hours]
C Programming: Getting Started, Variables and Arithmetic expressions. Input and Output: Standard input and output, formatted output- printf, variable length argument list, formatted input-scanf. Control Flow: Statements and Blocks, If-else, else-if, switch, loops: while loop, for loop, do while, break and continue, goto and labels. Pointers and Arrays: pointers and address, pointers and function arguments, multidimensional array, initialization of pointer arrays, command line arguments.

UNIT - III   [16 Hours]
Factoring Methods: Finding the square root of a number, the smallest Divisor of an integer, the greatest common divisor of two integers, generating prime numbers, computing the prime factors of an integer, generation of pseudo random numbers, raising a number to a large power, computing the nth Fibonacci Number. Array Techniques: Array order Reversal, Array counting or Histogramming, Finding the maximum number in a set, removal of duplicates from an ordered array, partitioning an array, Finding the kth smallest element, multiplication of two matrices.

UNIT - IV   [16 Hours]
Merging: the two-way merge. Sorting: Sorting by selection, sorting by exchange, sorting by insertion, sorting by diminishing increment, sorting by partitioning. Searching: binary search, hash search. Text processing and Pattern searching: text line length adjustment, left and right justification of text, keyword searching in text, text line editing, linear pattern search, sublinear pattern search.

Text Books:
1. R.G.Dromey, "How to Solve it by Computer", Pearson Education India, 2008.
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", 3rd Edition, The MIT Press Cambridge, Massachusetts London, England, 2009.

3. Brain M. Kernighan, and Dennis M. Ritchie, "The C Programming Language", 2nd edition, Princeton Hall Software Series, 2012.

Reference Books:
1. Steven S. Skiena, "The Algorithm Design Module", 2nd Edition, Springer-Verlag London Limited, 2008.
2. Donald E. Knuth, The Art of Computer Programming", Volume 1: Fundamental Algorithms, 3rd Edition, Addison Wesley Longman, 1997.
3. Donald E. Knuth, The Art of Computer Programming", Volume 2: Seminumerical Algorithms, 3rd Edition, Addison Wesley Longman, 1998.
4. Greg Perry and Dean Miller, "C programming Absolute Beginner's Guide", 3rd edition, Pearson Education, Inc, 2014.

Web Resources:
1. http://algorithmsforinterviews.com "Algorithms for Interviews"

CS-C2P: Problem Solving Using C HLL

Write, and execute C program for the following:

1. to read radius of a circle and to find area and circumference
2. to read three numbers and find the biggest of three
3. to check whether the number is prime or not
4. to read a number, find the sum of the digits, reverse the number and check it for palindrome
5. to read numbers from keyboard continuously till the user presses 999 and to find the sum of only positive numbers
6. to read percentage of marks and to display appropriate message (Demonstration of else-if ladder
7. to find the roots of quadratic equation
8. to read marks scored by n students and find the average of marks (Demonstration of single dimensional array)
9. to remove Duplicate Element in a single dimensional Array
10. to perform addition and subtraction of Matrices
11. to find factorial of a number
12. to generate fibonacci series
13. to remove Duplicate Element in a single dimensional Array
14. to find the length of a string without using built in function
15. to demonstrate string functions
16. to read, display and add two m x n matrices using functions
17. to read a string and to find the number of alphabets, digits, vowels, consonants, spaces and special characters.
18. to Swap Two Numbers using Pointers
19. to demonstrate student structure to read & display records of n students
20. to demonstrate the difference between structure & union.

CS-C3T - DATA STRUCTURES

Total Teaching Hours: 64   No. of Hours / Week: 04

UNIT-I   [16 Hours]
Introduction and Overview: Definition, Elementary data organization, Data Structures, data Structures operations, Abstract data types, algorithms complexity, time-space trade off. Preliminaries: Mathematical notations and functions, Algorithmic notations, control structures, Complexity of algorithms, asymptotic notations for complexity of algorithms. String Processing: Definition, Storing Strings, String as ADT, String operations, word/text processing, Pattern Matching algorithms.

UNIT-II   [16 Hours]
Arrays: Definition, Linear arrays, arrays as ADT, Representation of Linear Arrays in Memory,
Traversing Linear arrays, Inserting and deleting, Multi-dimensional arrays, Matrices and Sparse matrices. Linked list: Definition, Representation of Singly Linked List in memory, Traversing a Singly linked list, Searching in a Singly linked list, Memory allocation, Garbage collection, Insertion into a singly linked list, Deletion from a singly linked list; Doubly linked list, Header linked list, Circular linked list. Stacks: Definition, Array representation of stacks, Linked representation of stacks, Stack as ADT, Arithmetic Expressions: Polish Notation, Conversion of infix expression to postfix expression, Evaluation of Post fix expression, Application of Stacks, Recursion, Towers of Hanoi, Implementation of recursive procedures by stack. Queues: Definition, Array representation of queue, Linked list representation of queues. Types of queue: Simple queue, Circular queue, Double-ended queue, Priority queue, Operations on Queues, Applications of queues.

UNIT-III   [16 Hours]
Binary Trees: Definitions, Tree Search, Traversal of Binary Tree, Tree Sort, Building a Binary Search Tree, Height Balance: AVL Trees, Contiguous Representation of Binary Trees: Heaps,Lexicographic Search Trees: Tries, External Searching: B-Trees, Applications of Trees.Graphs: Mathematical Back ground, Computer Representation, Graph Traversal, TopologicalSorting, Greedy Algorithm, Graphs as Data Structure.

UNIT-IV   [16 Hours]
Searching: Introduction and Notation, Sequential Search, Binary Search, Comparison of Methods. Sorting: Introduction and Notation, Insertion Sort, Selection Sort, Shell Sort, DivideAnd Conquer, Merge sort for Linked List, Quick sort for Contiguous List. Hashing: SparseTables, Choosing a Hash function, Collision Resolution with Open Addressing, CollisionResolution by Chaining.

Text Books:
1. Seymour Lipschutz, "Data Structures with C", Schaum's outLines, Tata Mc Graw Hill, 2011.
2. Robert Kruse, C.L.Tondo, Bruce Leung,Shashi Mogalla,"Data Structures and Program Design usingC", Pearson Education, 2009.

ReferenceBooks:
1. Mark Allen Weiss," Data Structures and Algorithm Analysis in C", Second Edition, Pearson Education,2013
2. Forouzan,"A Structured Programming Approach using C",2nd Edition, Cengage LearningIndia,2008.

CS-C4P: DATA STRUCTURES LAB PROGRAMS

NOTE: For all the programs write the output, flowchart and number of basic operations performed.

1. Given {4,7,3,2,1,7,9,0} find the location of 7 using Linear and Binary search and also display its first occurrence.

2. Given {5,3,1,6,0,2,4} order the numbers in ascending order using Bubble Sort Algorithm

3. Perform the Insertion and Selection Sort on the input {75,8,1,16,48,3,7,0} and display the output in descending order.

4. Write a program to insert the elements {61,16,8,27} into singly linked list and delete 8,61,27 from the list. Display your list after each insertion and deletion.

5. Write a program to insert the elements {61,16,8,27} into linear queue and delete three elements from the list. Display your list after each insertion and deletion.

6. Write a program to insert the elements {61,16,8,27} into circular queue and delete 4 elements from the list. Display your list after each insertion and deletion.

7. Write a program to insert the elements {61,16,8,27} into ordered singly linked list and delete 8,61,27 from the list. Display your list after each insertion and deletion.

8. Write a program to add $6x^3+10x^2+0x+5$ and $4x^2+2x+1$ using linked list.

9. Write a program to push 5,9,34,17,32 into stack and pop 3 times from the stack, also display the popped numbers.

10. Write a recursive program to find GCD of 4,6,8.

11. Write a program to inert the elements {5,7,0,6,3,9} into circular queue and delete 6,9&5 from it(using linked list implementation)..

12. Write a program to convert an infix expression x^y/(5*z)+2 to its postfix expression

13. Write a program to evaluate a postfix expression 5 3+8 2 - *.

14. Write a program to create a binary tree with the elements {18,15,40,50,30,17,41} after creation insert 45 and 19 into tree and delete 15,17 and 41 from tree. Display the tree on each insertion and deletion operation

15. Write a program to create binary search tree with the elements {2,5,1,3,9,0,6} and perform inorder, preorder and post order traversal.

16. Write a program to Sort the following elements using heap sort {9.16,32,8,4,1,5,8,0}

17. Given S1={"Flowers"} ; S2={"are beautiful"} I. Find the length of S1 II. Concatenate S1 and S2 III. Extract the substring "low" from S1 IV. Find "are" in S2 and replace it with "is"

CS-C5T: OBJECT ORIENTED PROGRAMMING USING JAVA

Total Teaching Hours: 64   No. of Hours / Week: 04

UNIT-I   [16 Hours]
Introduction to Java: Basics of Java programming, Data types, Variables, Operators, Control structures including selection, Looping, Java methods, Overloading, Math class, Arrays in java. Objects and Classes: Basics of objects and classes in java, Constructors, Finalizer, Visibility modifiers, Methods and objects, Inbuilt classes like String, Character, String Buffer, File, this reference

UNIT-II   [16 Hours]
Inheritance and Polymorphism: Inheritance in java, Super and sub class, Overriding, Object class, Polymorphism, Dynamic binding, Generic programming, Casting objects, Instance of operator, Abstract class, Interface in java, Package in java, UTIL package.

UNIT-III   [16 Hours]
Event and GUI programming: Event handling in java, Event types, Mouse and key events, GUI Basics, Panels, Frames, Layout Managers: Flow Layout, Border Layout, Grid Layout, GUI components like Buttons, Check Boxes, Radio Buttons, Labels, Text Fields, Text Areas, Combo Boxes, Lists, Scroll Bars, Sliders, Windows, Menus, Dialog Box, Applet and its life cycle, Introduction to swing, Exceptional handling mechanism. I/O programming: Text and Binary I/O, Binary I/O classes, Object I/O, Random Access Files.

UNIT-IV   [16 Hours]
Multithreading in java: Thread life cycle and methods, Runnable interface, Thread synchronization, Exception handling with try-catch-finally, Collections in java, Introduction to JavaBeans and Network Programming.

Textbooks:
1. E. Balagurusamy, Programming with JAVA, McGraw Hill, New Delhi, 2007

Reference Books:
1. Raj Kumar Buyya, Object Oriented Programming with JAVA, McGraw Hill, 2009
2. Herbert Schildt, Java A Beginner's Guide – Create, Compile, and Run Java Programs Today, Sixth Edition, Oracle Press, 2014
3. Ken Arnold, James Gosling, "The Java Programming Language, Fourth Edition, Addison Wisely, 2005
4. Herbert Schildt, 'The Complete Reference Java, 7th Edition, McGraw Hill, 2007

Web Resources
1. https://docs.oracle.com/javase/tutorial/
2. https://javabeginnertutorial.com/core-java-tutorial/

CS-C6T: JAVA PROGRAMMING LAB

1. Write a simple java application, to print the message, "Welcome to java"
2. Write a program to display the month of a year. Months of the year should be held in an array.
3. Write a program to demonstrate a division by zero exception
4. Write a program to create a user defined exception say Pay Out of Bounds. .
5. Write a java program to add two integers and two float numbers. When no arguments are supplied, give a default value to calculate the sum. Use function overloading.
6. Write a program to perform mathematical operations. Create a class called AddSub with methods to add and subtract. Create another class called MulDiv that extends from AddSub class to use the member data of the super class. MulDiv should have methods to multiply and divide A main function should access the methods and perform the mathematical operations.
7. Write a program with class variable that is available for all instances of a class. Use static variable declaration. Observe the changes that occur in the object's member variable values.
8. Write a java program to create a student class with following attributes: Enrollment_id: Name, Mark of sub1, Mark of sub2, mark of sub3, Total Marks. Total of the three marks must be calculated only when the student passes in all three subjects. The pass mark for each subject is 50. If a candidate fails in any one of the subjects his total mark must be declaredas zero. Using this condition write a constructor for this class. Write separate functions for accepting and displaying student details. In the main method create an array of three student objects and display the details.
9. In a college first year class are having the following attributesName of the class (BCA, BCom, BSc), Name of the staff No of the students in the class, Array of students in the class
10. Define a class called first year with above attributes and define a suitable constructor. Also write a method called best Student () which process a first-year object and return the student with the highest total mark. In the main method define a first-year object and find the best student of this class
11. Write a Java program to define a class called employee with the name and date of appointment. Create ten employee objects as an array and sort them as per their date of appointment. ie, print them as per their seniority.
12. Create a package' student.Fulltime.BCA' in your current working directory
    a. Create a default class student in the above package with the following
    attributes: Name, age, sex. b. Have methods for storing as well as displaying
13. Write a small program to catch Negative Array Size Exception. This exception is caused when the array is initialized to negative values.
14. Write a program to handle Null Pointer Exception and use the "finally" method to display a messageto the user.
15. Write a program which create and displays a message on the window
16. Write a program to draw several shapes in the created window
17. Write a program to create an applet and draw grid lines
18. Write a program which creates a frame with two buttons father and
    mother. When we click the father button the name of the father, his age and designation must appear.
    When we click mother similar details of mother also appear.

19. Create a frame which displays your personal details with respect to a button click
20. Create a simple applet which reveals the personal information of yours.
21. Write a program to move different shapes according to the arrow key pressed.
22. Write a java Program to create a window when we press M or m the window displays Good Morning, A or a the window displays Good After Noon E or e the window displays Good Evening, N or n the window displays Good Night
23. Demonstrate the various mouse handling events using suitable example.
24. Write a program to create menu bar and pull-down menus.

CS-C7T: OPERATING SYSTEMS

Total Teaching Hours: 64   No. of Hours / Week: 04

UNIT - I   [16 Hours]

Introduction: Computer System Organization, Architecture, Structure, Operations, Process Management, Memory Management, Storage Management, Kernel Data Structures, Computing Environments. Operating System Structures: Services, System Calls, Types, Operating System Structure, System Boot. Processes: Process Concept, Scheduling, Operations, Interprocess Communication. Multithreaded Programming: Multicore Programming, Multithreading Models.

UNIT –II   [16 Hours]

Process Synchronization: The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Mutex Locks, Semaphores, Classic Problems of Synchronization, Monitors, Synchronization Examples. Process Scheduling: Criteria, Scheduling Algorithms, Multi-Processor Scheduling, Real-time CPU Scheduling. Deadlocks: System model, Characterization, Methods for handling deadlocks, Deadlock Prevention, Avoidance, Detection and Recovery from deadlock.

UNIT – III   [16 Hours]

Memory Management Strategies: Background, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of the Page Table. Virtual Memory Management: Demand Paging; Copy-on-Write, Page Replacement; Allocation of Frames; Thrashing, Memory-Mapped Files, Allocating Kernel Memory. File System: File Concept, Access Methods, Directory and Disk Structure, Protection. File-System Implementation: Structure, File-System and Directory Implementation, Allocation Methods, Free Space Management, Efficiency and Performance, Recovery. Mass-Storage Structure: Overview, Disk Scheduling, Disk Management.

UNIT - IV   [16 Hours]

Protection: Goals, Principles, Domain of Protection, Access Matrix, Implementation of the Access Matrix, Access Control, Revocation of the Access Rights. Virtual Machines: Building Blocks, Types of VMs and their implementations. Distributed Systems: Advantages, Types of Network-based OS, Robustness, Design Issues, Distributed File Systems. Case Studies: The Linux System, Windows 10.

Text Books:
1.   Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating Systems Concepts, 9th Edition, 2016 India, Wiley.

Reference Books:
1. William Stallings, "Operating Systems-Internals and Design Principles", Pearson, 9th Edition, 2018
2. D M Dhamdhere: Operating Systems – A Concept Based Approach, 3rd Edition, Tata McGraw –Hill, 2015.
3. Harvey M Deitel, Paul J Deitel, Dr Choffnes,"Operating Systems", Pearson Education Limited, 3rd Edition, 2013.
4. J. Archer Harris, John Cordani, " Operating Systems", Schaum's Outline, Indian Edition, Mc Graw Hill Education (India), First Edition.
5. Gary Nutt, Nabendu Chaki, Sarmistha Neog, "Operating Systems" Pearson Education Limited, 3rd Edition, 2016.

CS-C8P: UNIX LAB
PART-A

1. Learn the use of basic UNIX commands –
   a. To access information using date, history, man, who, whoami, uptime, finger, cal.

   b. To display contents of files using cat, vi, more, head, tail, grep, cmp, wc

   c. To manage files using cat, cp, ls, mv, rm, chmod, find

   d. Process utilities using ps, pid, ppid, tty, time, kill, exit

   e. Directory handling utilities using cd, mkdir, rmdir, mv, pwd

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

3. Write a shell script that accepts a list of file names as its arguments, count and reports the occurrence of each word that is present in the first argument file on other argument files.

4. Write a shell script that accepts one or more file name as arguments and converts all of them to uppercase, provided they exist in the current directory.

5. Write grep commands to the following:
   a. To select the lines from a file that has exactly 2 characters.
   b. To select the lines from a file that has more2 than one blank spaces.

6. Write a shell script which accepts two file names as arguments. Compare the contents. If they are same, then delete the second file.

7. Write a shell script
   a. to count number of lines in a file that do not contain vowels.
   b. to count number of characters, words, lines in a given file.

8. Write a shell script to list all the files in a given directory.

9. Write a shell script to display list of users currently logged in.

10. Write a shell script to read three text files in the current directory and merge them into a single file and returns a file descriptor for the new file.

PART-B

1. Write a program to copy a file into another using system calls.

2. Write a program using system call: create, open, write, close, stat, fstat, lseek.

3. Write a program to create a child process and allow the parent to display "parent" and the child to display "child" on the screen.

4. Write a program to create a Zombie process.

5. Write a program to implement inter process communication using pipes.

6. Simulate the following CPU scheduling algorithms
   a. Round Robin
   b. SJF

7. Write a program that illustrates file locking using semaphores.

8. Write a program that implements a producer-consumer system with two processes (using semaphores).

9. Write a program that illustrates inter process communication using shared memory system calls.

10. Write a program that illustrates the following:
    a. Creating message queue.
    b. Writing to a message queue
    c. Reading from a message queue

Reference Books:

1. Sumitabha Das: "UNIX Concepts and Applications", 4th Edition, Tata McGraw Hill, 2006.

2. Kenneth Roson et al ,"UNIX: The Complete Reference", McGraw-Hill Osborne Media

3. M G Venkateshmurthy,"UNIX and Shell Programming", Pearson Education Asia, 2005

4. Behrouz A. Forouzan, Richard F. Gilberg,"Unix and shell Programming.", Brooks/Cole-Thomson Learning, 2003

5. Uresh Vahalia, "UNIX Internals", Pearson Education, 2005.

6. Richard Stevens, Stephen Rago, "Advanced Programming in the UNIX Environment", Pearson Education, 2/e.

BENGALURU CITY UNIVERSITY

CHOICE BASED CREDIT SYSTEM

(Semester Scheme with Multiple Entry and Exit Options for

Under Graduate Course- as per NEP 2020)

Syllabus for B.Sc. Computer Science
(III & IV Semester)

2022-23 onwards

BANGALORE CITY UNIVERSITY

Proceeding of the meeting of the Board of Studies in Computer Science, held online on
19-09-2022 at 11.00 am

The Following Members were present:
1. Dr. Susesha, Professor, PG Department of Computer Science, Mysore University
2. Dr. Prabhakar C.J, Professor, Kuvempu University, Shimogga
3. Dr. Chandrakanth Naikodi, Associate Professor, PG Department of Computer Science, Davanagere University
4. Dr. Prathibha V Kalburgi, Ramaiah College of Arts Science, and Commerce, Bangalore
5. Mrs. Amalorpavam, Sambram Academi of Management Studies, Bangalore
6. Dr. Muralidhara B L, Professor, Department of Computer Science, Bangalore University

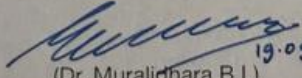The Following member is diseased
1. Late. Malathi Palani. A

The Following Members could not attend the meeting:
1. Dr. Guru D.S, Professor, PG Department of Computer Science, Mysore University
2. Dr. H.K. Gundurao, Associate Professor, Vijaya College, Bangalore
3. Dr. Bhagyawana S Mudigowda, Associate Professor, Maharani Cluster University
4. Smt. Nagarathnamma S.M, Associate Professor, Maharani Cluster University

The Chairperson welcomed the members and briefed the members on the proposed syllabus. The Committee discussed the syllabus in detail and approved the following syllabus:
1. Syllabus for the III, and IV semester of NEP BCA
2. Syllabus for the III, and IV semester of NEP B.Sc. Computer Science
3. Syllabus for the III, and IV semester of NEP B.Voc
4. Open Elective for the III and IV Semester Computer Science

The Chairperson thanked all the members for their active participation.

19.09.2022

(Dr. Muralidhara B L)
Chairperson

DR. MURALIDHARA B.L / ಡಾ. ಮುರಳೀಧರ.ಬಿ.ಎಲ್
Professor / ಪ್ರಾಧ್ಯಾಪಕರು
Department of Computer Science / ಗಣಕಶಾಸ್ತ್ರ ವಿಭಾಗ
Bangalore University / ಬೆಂಗಳೂರು ವಿಶ್ವವಿದ್ಯಾಲಯ
Jnanabharathi, Bangalore / ಬೆಂಗಳೂರು-560056

Semester	Course Code	Title of the Paper	Credits	Languages, Skill Enhancement (SEC), and Ability Enhancement Courses (AECC)	Credits	Total Credits
I	CS-C1T	Problem Solving Techniques	4	OE1: Open Elective	3	25
	CS-C2P	Problem Solving Lab using C HLL	2	Language L1	3	
	XX	Other Option Theory	4	Language L2	3	
	XX	Other Option LAB	2	SEC I :	2	
				Physical Education	1	
				Health & Wellness	1	
II	CS-C3T	Data Structure	4	OE2: Open Elective	3	25
	CS-C4P	Data Structures Lab	2	Language L1	3	
	XX	Other Option Theory	4	Language L2	3	
	XX	Other Option LAB	2	Environmental studies	2	
				Physical Education	1	
				NCC/NSS/CL/R&R	1	
III	CS-C5T	Object Oriented Programming using Java	4	OE3: Open Elective	3	25
	CS-C6P	Java Lab	2	Language L1	3	
	XX	Other Option Theory	4	Language L2	3	
	XX	Other Option LAB	2	SEC II :	2	
				Physical Education	1	
				NCC/NSS/CL/R&R	1	
IV	CS-C7T	Operating Systems	4	OE4: Open Elective	3	25
	CS-C8P	Linux Lab	2	Language L1	3	
	XX	Other Option Theory	4	Language L2	3	
	XX	Other Option LAB	2	The Constitution of India	2	
				Physical Education	1	
				NCC/NSS/CL/R&R	1	
V	CS-C9T	Database Management System	3	Vocation Course I : Other Option (Major)	3	22
	CS-C10T	Artificial Intelligence	2	SEC III :	2	
	CS-C11P	Database Management System Lab	3	Physical Education	1	
	CS-C12P	Artificial Intelligence Lab	2	NCC/NSS/CL/R&R	1	
	XX	Other Option (Minor) LAB	3			
	XX	Other Option (Minor) LAB	2			

Semester	Course Code	Title of the Paper	Credits	Languages, Skill Enhancement (SEC), and Ability Enhancement Courses (AECC)	Credits	Total Credits
VI	CS-C13T	Python Programming	3	Vocation Course I : Technical Writing	3	24
	CS-C14T	Computer Networks	3	Internship	2	
	CS-C15P	Python Programming Lab	2	SEC III :	2	
	CS-C16P	Computer Networks Lab	2	Physical Education	1	
	XX	Other Option (Minor) Theory	3	NCC/NSS/CL/R&R	1	
	XX	Other Option (Minor) LAB	2			
VII	CS-C17T	Internet Technologies	3	Elective I: (Internet of Things, Cloud Computing, Data Mining, Image Processing, Discrete Structures, Modeling and Simulation)	3	22
	CS-C18T	Data Analytics	3	Elective II : (Internet of Things, Cloud Computing, Data Mining, Image Processing, Discrete Structures, Modeling and Simulation)	3	
	CS-C19T	Design and Analysis of Algorithm	3	Research Methodology	3	
	CS-C20P	Internet Technologies Lab	2			
	CS-C21P	Data Analytics Lab	2			
VIII	CA-C22T	Machine Learning	3	Elective III : (Block Chain Technologies, Operations Research, Human Computer Interface, Parallel Algorithms)	3	20
	CA-C23T	Theory of Computation	3	Research Project	6	
	CA-C24T	System Security	3			
	CA-C24P	Machine Learning Lab	2			

CS-C5T: OBJECT ORIENTED PROGRAMMING USING JAVA

Total Teaching Hours: 64   No. of Hours / Week: 04

UNIT-I   [16 Hours]
Introduction to Java: Basics of Java programming, Data types, Variables, Operators, Control structures including selection, Looping, Java methods, Overloading, Math class, Arrays in java. Objects and Classes: Basics of objects and classes in java, Constructors, Finalizer, Visibility modifiers, Methods and objects, Inbuilt classes like String, Character, String Buffer, File, this reference

UNIT-II   [16 Hours]
Inheritance and Polymorphism: Inheritance in java, Super and sub class, Overriding, Object class, Polymorphism, Dynamic binding, Generic programming, Casting objects, Instance of operator, Abstract class, Interface in java, Package in java, UTIL package.

UNIT-III   [16 Hours]
Event and GUI programming: Event handling in java, Event types, Mouse and key events, GUI Basics, Panels, Frames, Layout Managers: Flow Layout, Border Layout, Grid Layout, GUI components like Buttons, Check Boxes, Radio Buttons, Labels, Text Fields, Text Areas, Combo Boxes, Lists, Scroll Bars, Sliders, Windows, Menus, Dialog Box, Applet and its life cycle, Introduction to swing, Exceptional handling mechanism. I/O programming: Text and Binary I/O, Binary I/O classes, Object I/O, Random Access Files.

UNIT-IV   [16 Hours]
Multithreading in java: Thread life cycle and methods, Runnable interface, Thread synchronization, Exception handling with try-catch-finally, Collections in java, Introduction to JavaBeans and Network Programming.

Textbooks:
1. E. Balagurusamy, Programming with JAVA, McGraw Hill, New Delhi, 2007

Reference Books:
1. Raj Kumar Buyya, Object Oriented Programming with JAVA, McGraw Hill, 2009
2. Herbert Schildt, Java A Beginner's Guide – Create, Compile, and Run Java Programs Today, Sixth Edition, Oracle Press, 2014
3. Ken Arnold, James Gosling, "The Java Programming Language, Fourth Edition, Addison Wisely, 2005
4. Herbert Schildt, 'The Complete Reference Java, 7th Edition, McGraw Hill, 2007

Web Resources
1. https://docs.oracle.com/javase/tutorial/
2. https://javabeginnerstutorial.com/core-java-tutorial/

CS-C6T: JAVA PROGRAMMING LAB

1. Write a simple java application, to print the message, "Welcome to java"
2. Write a program to display the month of a year. Months of the year should be held in an array.
3. Write a program to demonstrate a division by zero exception
4. Write a program to create a user defined exception say Pay Out of Bounds. .
5. Write a java program to add two integers and two float numbers. When no arguments are supplied, give a default value to calculate the sum. Use function overloading.
6. Write a program to perform mathematical operations. Create a class called AddSub with methods to add and subtract. Create another class called MulDiv that extends from AddSub class to use the member data of the super class. MulDiv should have methods to multiply and divide A main function should access the methods and perform the mathematical operations.
7. Write a program with class variable that is available for all instances of a class. Use static variable declaration. Observe the changes that occur in the object's member variable values.
8. Write a java program to create a student class with following attributes: Enrollment_id: Name, Mark of sub1, Mark of sub2, mark of sub3, Total Marks. Total of the three marks must be calculated only when the student passes in all three subjects. The pass mark for each subject is 50. If a candidate fails in any one of the subjects his total mark must be declaredas zero. Using this condition write a constructor for this class. Write separate functions for accepting and displaying student details. In the main method create an array of three student objects and display the details.
9. In a college first year class are having the following attributesName of the class (BCA, BCom, BSc), Name of the staff No of the students in the class, Array of students in the class
10. Define a class called first year with above attributes and define a suitable constructor. Also write a method called best Student () which process a first-year object and return the student with the highest total mark. In the main method define a first-year object and find the best student of this class
11. Write a Java program to define a class called employee with the name and date of appointment. Create ten employee objects as an array and sort them as per their date of appointment. ie, print them as per their seniority.
12. Create a package' student.Fulltime.BCA' in your current working directory
    a. Create a default class student in the above package with the following
    attributes: Name, age, sex. b. Have methods for storing as well as displaying
13. Write a small program to catch Negative Array Size Exception. This exception is caused when the array is initialized to negative values.
14. Write a program to handle Null Pointer Exception and use the "finally" method to display a message to the user.
15. Write a program which create and displays a message on the window
16. Write a program to draw several shapes in the created window
17. Write a program to create an applet and draw grid lines
18. Write a program which creates a frame with two buttons father and
    mother. When we click the father button the name of the father, his age and designation must appear. When we click mother similar details of mother also appear.

19. Create a frame which displays your personal details with respect to a button click
20. Create a simple applet which reveals the personal information of yours.
21. Write a program to move different shapes according to the arrow key pressed.
22. Write a java Program to create a window when we press M or m the window displays Good Morning, A or a the window displays Good After Noon E or e the window displays Good Evening, N or n the window displays Good Night
23. Demonstrate the various mouse handling events using suitable example.
24. Write a program to create menu bar and pull-down menus.

CS-C7T: OPERATING SYSTEMS

Total Teaching Hours: 64   No. of Hours / Week: 04

UNIT - I   [16 Hours]
Introduction: Computer System Organization, Architecture, Structure, Operations, Process Management, Memory Management, Storage Management, Kernel Data Structures, Computing Environments. Operating System Structures: Services, System Calls, Types, Operating System Structure, System Boot. Processes: Process Concept, Scheduling, Operations, Interprocess Communication. Multithreaded Programming: Multicore Programming, Multithreading Models.

UNIT –II   [16 Hours]
Process Synchronization: The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Mutex Locks, Semaphores, Classic Problems of Synchronization, Monitors, Synchronization Examples. Process Scheduling: Criteria, Scheduling Algorithms, Multi-Processor Scheduling, Real-time CPU Scheduling.   Deadlocks: System model, Characterization, Methods for handling deadlocks, Deadlock Prevention, Avoidance, Detection and Recovery from deadlock.

UNIT – III   [16 Hours]
Memory Management Strategies: Background, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of the Page Table. Virtual Memory Management: Demand Paging; Copy-on-Write, Page Replacement; Allocation of Frames; Thrashing, Memory-Mapped Files, Allocating Kernel Memory. File System: File Concept, Access Methods, Directory and Disk Structure, Protection. File-System Implementation: Structure, File-System and Directory Implementation, Allocation Methods, Free Space Management, Efficiency and Performance, Recovery. Mass-Storage Structure: Overview, Disk Scheduling, Disk Management.

UNIT - IV   [16 Hours]
Protection: Goals, Principles, Domain of Protection, Access Matrix, Implementation of the Access Matrix, Access Control, Revocation of the Access Rights. Virtual Machines: Building Blocks, Types of VMs and their implementations. Distributed Systems: Advantages, Types of Network-based OS, Robustness, Design Issues, Distributed File Systems. Case Studies: The Linux System, Windows 10.

Text Books:
1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating Systems Concepts, 9th Edition, 2016 India, Wiley.

Reference Books:
1. William Stallings, "Operating Systems-Internals and Design Principles", Pearson, 9th Edition, 2018
2. D M Dhamdhere: Operating Systems – A Concept Based Approach, 3rd Edition, Tata McGraw –Hill, 2015.
3. Harvey M Deitel, Paul J Deitel, Dr Choffnes,"Operating Systems", Pearson Education Limited, 3rd Edition, 2013.
4. J. Archer Harris, John Cordani, " Operating Systems", Schaum's Outline, Indian Edition, Mc Graw Hill Education (India), First Edition.
5. Gary Nutt, Nabendu Chaki, Sarmistha Neog, "Operating Systems" Pearson Education Limited, 3rd Edition, 2016.

CS-C8P: UNIX LAB
PART-A

1. Learn the use of basic UNIX commands –
   a. To access information using date, history, man, who, whoami, uptime, finger,cal.
   b. To display contents of files using cat, vi, more, head, tail, grep, cmp, wc
   c. To manage files using cat, cp, ls, mv,rm, chmod, find
   d. Process utilities using ps, pid, ppid, tty, time, kill, exit
   e. Directory handling utilities using cd, mkdir, rmdir, mv, pwd

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

3. Write a shell script that accepts a list of file names as its arguments, count and reports the occurrence of each word that is present in the first argument file on other argument files.

4. Write a shell script that accepts one or more file name as arguments and converts all of them to uppercase, provided they exist in the current directory.

5. Write grep commands to the following:
   a. To select the lines from a file that has exactly 2 characters.
   b. To select the lines from a file that has more2 than one blank spaces.

6. Write a shell script which accepts two file names as arguments. Compare the contents. If they are same, then delete the second file.

7. Write a shell script
   a. to count number of lines in a file that do not contain vowels.
   b. to count number of characters, words, lines in a given file.

8. Write a shell script to list all the files in a given directory.

9. Write a shell script to display list of users currently logged in.

10. Write a shell script to read three text files in the current directory and merge them into a single file and returns a file descriptor for the new file.

PART-B

1. Write a program to copy a file into another using system calls.

2. Write a program using system call: create, open, write, close, stat, fstat, lseek.

3. Write a program to create a child process and allow the parent to display "parent" and the child to display "child" on the screen.

4. Write a program to create a Zombie process.

5. Write a program to implement inter process communication using pipes.

6. Simulate the following CPU scheduling algorithms
   a. Round Robin
   b. SJF

7. Write a program that illustrates file locking using semaphores.

8. Write a program that implements a producer-consumer system with two processes (using semaphores).

9. Write a program that illustrates inter process communication using shared memory system calls.

10. Write a program that illustrates the following:
    a. Creating message queue.
    b. Writing to a message queue
    c. Reading from a message queue

Reference Books:

1. Sumitabha Das: "UNIX Concepts and Applications", 4th Edition, Tata McGraw Hill, 2006.
2. Kenneth Roson et al ,"UNIX: The Complete Reference", McGraw-Hill Osborne Media
3. M G Venkateshmurthy,"UNIX and Shell Programming", Pearson Education Asia, 2005
4. Behrouz A. Forouzan, Richard F. Gilberg,"Unix and shell Programming.", Brooks/Cole-Thomson Learning, 2003
5. Uresh Vahalia, "UNIX Internals", Pearson Education, 2005.
6. Richard Stevens, Stephen Rago, "Advanced Programming in the UNIX Environment", Pearson Education, 2/e.

Open Elective courses offered by the
Department of Computer Science

Open Elective 3: Fundamentals of HTML & CSS

Course Code: CSOE04	Fundamentals of HTML & CSS
Course Credits: 03	Hours/Week: 03
Total Contact Hours: 42	Formative Assessment Marks: 40
Exam Marks: 60	Exam Duration:

Introduction to HTML

History of HTML - What you need to do to get going and make your first HTML page - What are HTML Tags and Attributes? - HTML Attributes - How to differentiate HTML Document Versions- Introduction and Advantages of HTML 5 - Limitations of HTML 4 - First HTML5 Document - Overview of New Features of HTML5.

HTML-Basic Formatting

HTML Basic Tags - HTML Formatting Tags - HTML Color Coding - Div and Span Tags for Grouping -Table: , Lists: Unordered Lists - Ordered Lists - Definition list, Images: Image and Image Mapping, HTML-Iframe : Attributes Using - Iframe as the Target, Hyperlink: URL - Uniform Resource Locator - URL Encoding. Semantic elements: Header - Navigation - Section & Articles - Footer – Aside

Web Forms

Web Forms: HTML 5 Global Attributes - Displaying a Search Input Field - Utilizing Date and Time Input Fields - Number Inputs - Selecting from a Range of Numbers - Selecting Colors - Creating an Editable Drop-Down - Requiring a Form Field - Displaying Placeholder Text - Disabling Autocomplete - Restricting Values.

CSS

Introduction: CSS Versions History - Benefits of CSS - What CSS3 Is and How It Came to Be - CSS3 Is Modular - CSS3 Is Not HTML5- Browser-Specific Prefixes, Syntax: CSS Syntax - single Style Sheets - Multiple Style Sheets - Value Lengths and Percentages, Selectors: ID Selectors - Class Selectors - Grouping Selectors - Universal Selector - Descendant / Child Selectors - Attribute Selectors, CSS-Color Background Cursor, Text Fonts, -Lists Tables, transformations.

Readings:
1. HTML5 and CSS3 visual quick start guide 7th edition

2. Black Book, HTML 5, Dreamtech Press

3. Ralph Moseley and M. T. Savaliya, Developing Web Applications, Wiley-India

Open Elective 4: Database Management System

Course Code: CSOE04	Database Management Systems
Course Credits: 03	Hours/Week: 03
Total Contact Hours: 42	Formative Assessment Marks: 40
Exam Marks: 60	Exam Duration:

Course Outcomes (COs):

After completing this course satisfactorily, a student will be able to:

* Understand relevance of Databases and DBMS.
* Appreciate the purpose of SQL and learn to use SQL DDL and DML commands
* Write SQL for Join operations and aggregation.
* Obtain insights about transactions and apply all the SQL DDL, DML commands

Content	Hours
Unit – 1	
Introduction to Databases & DBMS: **Introduction**: File Systems, File storage and its limitations, The Database Approach, Database Management Systems, DBMS advantages and limitations, **DBMS Concepts**: Database Schema, Meta-Data/ Data Dictionary, Constraints, **Relational Data Model Concepts:** Relation, Attributes, Tuples, Domain, Cardinality, Degree. Keys – Candidate key, Primary key, Composite key, foreign key.	12 Hrs
Unit – 2	
Introduction to SQL: SQL and its features, SQL Data types, **DDL:** Create tables (with constraints), Alter tables, **DML:** Insert, Update, Delete Operations, **Queries:** Simple Queries, select with WHERE clause, ORDER BY clause and aggregate functions, Using operators like BETWEEN , IN , ANY , ALL and computations in queries, Simple Queries using all clauses	10 Hrs
Unit – 3	
More on SQL: Joins, types of joins , queries with GROUP BY clause, queries with HAVING clause, views and their relevance, creating and using views, simple example queries for joining tables and using GROUP BY and HAVING clause	10 Hrs
Unit – 4	

Case Study: The University Database has the following tables: STUDENT(usn, name, address, date_of_birth, program_cd, semester) DEPARTMENT(dept_cd, dept_name, HOD_cd) (HOD_cd is foreign key which references **faculty_cd** of **FACULTY** table) FACULTY(faculty_cd, name, address, date_of_join, dept_cd) Program(program_cd, program_name, dept_cd) (Each Department offers multiple programmes eg: BCA, MCA are offered by CS department) Write SQL DDL and DML statements for the following: 1. Create all the tables defining primary keys and foreign keys. 2. Add the column email_id to the STUDENT table 3. Insert minimum three tuples in each of the tables. 4. Update the date_of_birth of a specific student. 5. Delete the data of a specific faculty. 6. Display all the programmes taught by Computer Science department 7. Display all the faculties who teach in the Math department. 8. Display the number of faculty members in each department 9. Display the student usn, name along with the programme (program name) he is studying 10. Display all the department names along with the names of their HODs.	10 Hrs

Reference Books:
1. Elmasri, Navathe , Fundamentals of Database Systems (5th Edition), Pearson
2. Alan Beaulieu, Learning SQL – 2nd Edition, O'Reilly Publications

Web Resources:

1. https://ncert.nic.in/textbook/pdf/keip107.pdf

2. https://ncert.nic.in/textbook/pdf/keip108.pdf

BENGALURU CITY UNIVERSITY

CHOICE BASED CREDIT SYSTEM
(Semester Scheme with Multiple Entry and Exit Options for
Under Graduate Course)

Syllabus for B.Sc. Computer Science
(V & VI Semester)

2023-24 onwards

BANGALORE CITY UNIVERSITY

PROCEEDINGS OF THE MEETING OF BOARD OF STUDIES HELD IN COMPUTER SCIENCE (UG AND PG), BANGALORE UNIVERSITY HELD ON 09-09-2023 THROUGH ONLINE MODE AT 11:30 AM

The following members were present:

1. Dr. Guru D.S, Department of Computer Science , Mysore Univeristy
2. Dr. Susesha , Department of Computer Science , Mysore Univeristy
3. Dr. Prabhakar C.J , Kuvempu University, Shimogga
4. Dr. Chandrakanth Naikodi,Department of Computer Science ,Davanagere University
5. Dr. Prathibha V Kalburgi ,Ramaiah College of Arts Science, and Commerce Bangalore
6. Mrs. Amalorpavam ,Sambram Academi of Management Studies ,Bangalore
7. Smt. Nagarathnamma S.M,Maharani Cluster Univeristy, Bangalore
8. Dr. B.L Muralidhara, Department of Computer Science, Bangalore University - Chairperson

The Following Members did not attend the meeting:

1. Dr. Bhagyawana S Mudigowda ,Maharani Cluster University, Bangalore

The Chairperson presented the syllabus of the V and VI semester BCA (NEP), B.Sc. Computer Science and BVoC (Computer Science) to the Committee. The Committee discussed the syllabus in detail and approved the same.

The Chairperson thanked all members for their active participation.

(Dr. B.L Muralidhara) 09.09.2023
Chairman, BoS – Computer Science

1	Dr. Muralidhara B L Professor Department of Computer Science Bangalore University	CHAIRPERSON
2	Dr. Guru D.S Professor PG Department of Computer Science Mysore Univeristy	Member
3	Dr. Susesha Professor, PG Department of Computer Science Mysore Univeristy	Member
4	Dr. Prabhakar C.J Professor Kuvempu University, Shimogga	Member
5	Dr. Chandrakanth Naikodi Associate Professor Department of Computer Science Davanagere University	Member
6	Dr. Prathibha V Kalburgi Ramaiah College of Arts Science, and Commerce Bangalore	Member
7	Mrs. Amalorpavam Sambram Academi of Management Studies Bangalore	Member
8	Dr. Bhagyawana S Mudigowda Associate Professor Maharani Cluster University, Bangalore	Member
9	Smt. Nagarathnamma S.M Associate Professor Maharani Cluster Univeristy, Bangalore	Member

Semester	Course Code	Title of the Paper	Credits	Languages, Skill Enhancement (SEC), and Ability Enhancement Courses (AECC)	Credits	Total Credits
I	CS-C1T	Problem Solving Techniques	4	OE1: Open Elective	3	25
	CS-C2P	Problem Solving Lab using C	2	Language L1	3	
	XX	Other Option Theory	4	Language L2	3	
	XX	Other Option LAB	2	SEC I :	2	
				Physical Education	1	
				Health & Wellness	1	
II	CS-C3T	Data Structure	4	OE2: Open Elective	3	25
	CS-C4P	Data Structures Lab	2	Language L1	3	
	XX	Other Option Theory	4	Language L2	3	
	XX	Other Option LAB	2	Environmental studies	2	
				Physical Education	1	
				NCC/NSS/CL/R&R	1	
III	CS-C5T	Object Oriented Programming using Java	4	OE3: Open Elective	3	25
	CS-C6P	Java Lab	2	Language L1	3	
	XX	Other Option Theory	4	Language L2	3	
	XX	Other Option LAB	2	SEC II :	2	
				Physical Education	1	
				NCC/NSS/CL/R&R	1	
IV	CS-C7T	Operating Systems	4	OE4: Open Elective	3	25
	CS-C8P	Linux Lab	2	Language L1	3	
	XX	Other Option Theory	4	Language L2	3	
	XX	Other Option LAB	2	The Constitution of India	2	
				Physical Education	1	
				NCC/NSS/CL/R&R	1	
V	CS-C9T	Database Management System	4	SEC III : Employability	3	27
	CS-C10T	Artificial Intelligence	4			
	CS-C11P	Database Management System Lab	2			
	CS-C12P	Artificial Intelligence Lab	2			
	XX	Other Option (Double Major)	12			

Semester	Course Code	Title of the Paper	Credits	Languages, Skill Enhancement (SEC), and Ability Enhancement Courses (AECC)	Credits	Total Credits
VI	CS-C13T	Python Programming	4	Internship	2	26
	CS-C14T	Computer Networks	4			
	CS-C15P	Python Programming Lab	2			
	CS-C16P	Computer Networks Lab	2			
	XX	Other Option (Double Major)	12			

CA-C9T: DATABASE MANAGEMENT SYSTEMS

Total Teaching Hours: 60   No. of Hours / Week: 04

UNIT - 1   [15 Hours]
Databases and Database Users: Introduction, An example, Characteristics of the Database
Approach, Actors on the Scene, Workers behind the Scene, Advantages of Using DBMS Approach,
A Brief History of Database Applications, When Not to Use a DBMS. Database System Concepts
and Architecture: Data Models, Schemas, and Instances, Three-schema Architecture and Data
Independence, Database Languages and Interfaces, The Database System Environment, Centralized
and Client-Server Architectures, Classification of Database Management Systems.

UNIT - 2   [15 Hours]
Data Modeling Using Entity-Relationship Model: Using High-Level Conceptual Data Models for
Database Design, An Example Database Application, Entity Types, Entity Sets, Attributes and
Keys, Relationship Types, Relationship Sets, Roles and Structural Constraints, Weak Entity Types,
Refining the ER Design Company Database Diagrams, Naming Conventions and Design. Issues,
File organization and storage, secondary storage devices, type of single level ordered index, multi-
level indexes, indexes on multiple keys, other types of indexes. Relational Model and Relational
Algebra: Relational Model Concepts, Relational Model Constraints and Relational Database
Schemas, Update Operations, Transactions and Dealing with Constraint Violations, Unary
Relational Operations: SELECT and PROJECT

UNIT – 3   [15 Hours]
Relational Algebra Operations from SET Theory, Binary Relational Operations: JOIN and
DIVISION, Additional Relational Operations, Examples of Queries in Relational Algebra.
Relational Database Design: Anomalies in a database, functional dependency, normal forms,
lossless join and dependency, BCNF, normalization through synthesis, higher order normal forms.
SQL- SQL Data Definition and Data Types, Specifying Constraints in SQL, Schema Change
Statements in SQL, Basic Queries in SQL, More Complex SQL Queries, Insert, Delete and Update
Statements in SQL, Specifying Constraints as Assertion and Trigger, Views(Virtual Tables) in
SQL, Embedded SQL, Dynamic SQL,

UNIT – 4   [15 Hours]
Introduction to transaction processing, transaction and system concepts, desirable properties of
transactions, transaction support in SQL. Concurrency control techniques: two-phase locking
techniques, concurrency control based on timestamp ordering. Recovery techniques: recovery
concepts, recovery in multi-database systems, database backup and recovery from catastrophic
failures.

Text Books:
1. Elmasri and Navathe: Fundamentals of Database Systems, 7th Edition, Addison -Wesley,
   2016.
2. Silberschatz, Korth and Sudharshan Data base System Concepts, 7th Edition, Tata McGraw
   Hill, 2019.

References:
1. C.J. Date, A. Kannan, S. Swamynatham: An Introduction to Database Systems, 8th Edition,
   Pearson education, 2009
2. Database Management Systems :Raghu Ramakrishnan and Johannes Gehrke: 3rd Edition,
   McGraw-Hill, 2003

CA-C10T: ARTIFICIAL INTELLIGENCE

Total Teaching Hours : 60   No. of Hours / Week: 04

Course Outcomes:
CO 1. Understand the various characteristics of problem solving agents and apply problem solving through search for AI applications.
CO 2. Appreciate the concepts of knowledge representation using Propositional logic and Predicate calculus and apply them for inference/reasoning.
CO 3. Obtain insights about Planning and handling uncertainty through probabilistic reasoning and fuzzy systems.
CO 4. Understand basics of computer vision and Natural Language Processing and understand their relevance in AI applications.
CO 5. Obtain insights about machine learning, neural networks, deep learning networks and their significance.

UNIT I :   [15 Hours]

Introduction to Al: Intelligent Agents: Agents and environment, the concept of Rationality, the nature of environment, the structure of agents; Problem solving: Problem-solving agents; Uninformed search strategies: DFS, BFS; Informed Search: Best First Search, A* search, AO* search; Adversarial Search & Games: Two-player zero-sum games, Minimax Search, Alpha-Beta pruning.

 UNIT – II   [15 Hours]

Knowledge-based Agents, The Wumpus world as an example world, Logic, Propositional logic, First-order predicate logic, Propositional versus first-order inference, Unification and lifting, Forward chaining, Backward chaining, Resolution, Truth maintenance systems.

UNIT - III   [15 Hours]

Introduction to Planning: Blocks World problem, Strips; Handling Uncertainties: Non-monotonic reasoning, Probabilistic reasoning, Fuzzy logic: Theory of Fuzzy sets, Operations on Fuzzy sets and Fuzzy logic, Reasoning with Fuzzy logic; Robotics: Fundamentals of Robotics, Robot Kinematics; Computer Vision: Introduction to image processing and classification, object detection.

UNIT – IV   [15 Hours]

Natural Language Processing: Introduction, Syntactic Processing, Semantic Analysis, Discourse and Pragmatic Processing; Expert Systems: Architecture and role of expert systems, two case studies of Expert Systems; Introduction to Machine learning: Supervised learning, unsupervised learning, reinforcement learning; Neural Networks: Introduction, basics of ANN,

Text Book/References

1. Russell, S. and Norvig, P.,   "Artificial Intelligence - A Modern Approach", 3rd edition, Prentice Hall

2. Nilsson Nils J, "Artificial Intelligence: A new Synthesis, Morgan Kaufmann Publishers Inc. San Francisco, CA, ISBN: 978-1-55-860467-4.

3. Dan W Patterson, "Introduction to Artificial Intelligence & Expert Systems", PHI Learning 2010.

CA- C11P: DATABASE MANAGEMENT SYSTEMS LAB

PART – A

1. Draw E-R diagram and convert entities and relationships to relation table for a given scenario. Two assignments shall be carried out i.e. consider two different scenarios (eg. bank, college)

Consider the Company database with following Schema

EMPLOYEE (FNAME, MINIT, LNAME, SSN, BDATE,ADDRESS,SEX,SALARY, SUPERSSN, DNO)

DEPARTMENT (DNAME, DNUMBER,MGRSSN,MSRSTARTDATE)

DEPT_LOCATIONS (DNUMBER, DLOCATION)

PROJECT (PNAME, PNUMBER, PLOCATION, DNUM)

WORKS_ON (ESSN, PNO<HOURS)

DEPENDENT (ESSN, DEPENDENT_NAME, SEX, BDATE, RELATIONSHIP)

2. Perform the following:

   a. Viewing all databases, Creating a Database, Viewing all Tables in a Database,

   Creating Tables (With and Without Constraints), Inserting/Updating/Deleting

   Records in a Table, Saving (Commit) and Undoing (rollback)

3. Perform the following:

   a. Altering a Table, Dropping/Truncating/Renaming Tables, Backing up / Restoring a

   Database.

4. For a given set of relation schemes, create tables and perform the following Simple Queries, Simple Queries with Aggregate functions, Queries with Aggregate functions (group by and having clause).

5. Execute the fallowing queries

   a. How the resulting salaries if every employee working on the „Research" Departments is given a 10% raise.

   b. Find the sum of the salaries of all employees of the „Accounts" department, as well as the maximum salary, the minimum salary, and the average salary in this department

6. Execute the fallowing queries
   a. Retrieve the name of each employee Controlled by Department number 5 (use EXISTS Operator).
   b. Retrieve the name of each dept and number of employees working in each Department which has at least 2 employees

7. Execute the fallowing queries
   a. For each project, retrieve the project number, the project name, and the number of Employee who   work on that project.(use GROUP BY)
   b. Retrieve the name of employees who born in the year 1990"s

8. For each Department that has more than five employees, retrieve the department number and number of employees who are making salary more than 40000.

9. For each project on which more than two employees work, retrieve the project number, project Name and the number of employees who work on that project.

10. For a given set of relation tables perform the following: Creating Views (with and without check option),Dropping views, Selecting from a view

PART B

Create the following tables with properly specifying Primary keys, Foreign keys and solve the Following queries.

    BRANCH (Branchid, Branchname, HOD)
    STUDENT (USN, Name, Address, Branchid, sem)
    BOOK (Bookid, Bookname, Authorid, Publisher, Branchid)
    AUTHOR (Authorid, Authorname, Country, age)
    BORROW (USN, Bookid, Borrowed_Date)

1. Perform the following:
   a. Viewing all databases, Creating a Database, Viewing all Tables in a Database, Creating Tables (With and Without Constraints), Inserting/Updating/Deleting Records in a Table, Saving (Commit) and Undoing (rollback)
   Execute the following Queries:

2. a. List the details of Students who are all studying in 2nd sem BCA.
   b. List the students who are not borrowed any books.

3. a. Display the USN, Student name, Branch_name, Book_name, Author_name, Books_Borrowed_ Date of 2nd sem BCA Students who borrowed books.
   b. Display the number of books written by each Author.

4. a. Display the student details who borrowed more than two books.
   b.Display the student details who borrowed books of more than one Author.

5. a. Display the Book names in descending order of their names.
   b. List the details of students who borrowed the books which are all published by the same publisher.

   Consider the following schema:
   STUDENT (USN, name, date_of_birth, branch, mark1, mark2, mark3, total, GPA)

6. Perform the following:
   a. Creating Tables (With and Without Constraints), Inserting/Updating/Deleting Records in a Table, Saving (Commit) and Undoing (rollback)

7. Execute the following queries:
   a. Find the GPA score of all the students.
   b. Find the students who born on a particular year of birth from the date_of_birth column.

8. a. List the students who are studying in a particular branch of study.
   b. Find the maximum GPA score of the student branch-wise.

ARTIFICIAL INTELLIGENCE LAB

Total Teaching Hours: **No. of Hours / Week:**

Course Outcomes:
CO 6. Solve search problems including heuristic search and constraint satisfaction search.
CO 7. Understand and apply image processing techniques for image enhancement, image detection and recognition.
CO 8. Understand and implement supervised machine learning and probabilistic machine learning algorithms.
CO 9. Implement unsupervised learning through clustering.
CO 10. Obtain insights about working of neural networks and neural network based learning.
CO 11. Perform NLP operations to gain understanding of text processing and analytics.

Please Note: Artificial Intelligence lab programs can be implemented in Python using the relevant Python libraries.

Lab Programs
1. Write a program to solve the Water Jug Problem using Breadth Frist Search (BFS).
2. Write a program to find the optimum path from Source to Destination using A* search technique.
3. Write a program to solve the 4 – Queens Problem.
4. Write a program to implement Minimax search for 2 Player games.
5. Using OpenCV python library capture an image and perform the following image processing operations:
   a) Image Resizing
   b) Blurring of Image
   c) Grayscaling of image
   d) Scaling and rotation
   e) Edge Detection
   f) Segmentation using thresholding
   g) Background subtraction
   h) Morphological operations
6. Write a program with two menu options 1) Capture Image and 2) Recognise Image. This program should capture pictures of five students and save them. The program should identify/recognise the student and display the student name.

Using Keras/any standard dataset write the programs for the following Machine learning tasks:
7. Use the Decision tree classifier to classify the dataset.
8. Use the Naïve Bayes classifier to classify the dataset.
9. Implement K-Means clustering Algorithm.

10. Using Python NLTK, perform the following Natural Language Processing (NLP) tasks for any textual content.
    a) Tokenizing
    b) Filtering Stop Words
    c) Stemming
    d) Part of Speech tagging
    e) Chunking
    f) Named Entity Recognition (NER)

11. Write a program that uses Neural networks for image classification using Keras Iris dataset.

CA-C13T: PYTHON PROGRAMMING

Total Teaching Hours : 60   No. of Hours / week: 04

UNIT - I   [15 Hours]
Parts Python Programming Language: Python Interpreter/Shell, Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data types, Indentation, Comments, Reading Input, Print Output, Type Conversions, The type() function and Is operator, Dynamic and Strongly Typed Language.**Control Flow Statements:**The if Decision Control Flow Statement, The if…else DecisionControl FlowStatement, The if…elif…else Decision Control Statement, Nested if Statement, The while Loop, TheforLoop, The continue and break Statements. **Functions**: Built-In Functions, Commonly Used Modules, Function Definition and Calling the Function, The return Statement and void Function, Scope and Life time of Variables, Default Parameters, Command Line Arguments. **Strings:** Creating and Storing Strings, Basic String operations,Accessing Characters in StringbyIndexNumber, String Slicing and Joining, String methods

UNIT - II   [15 Hours]
Lists: Creating Lists, BasicListOperations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, ThedelStatement, **Dictionaries:** Creating Dictionary, Accessing and modifying key:value pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary methods, ThedelStatement**. Tuples and Sets:** Creating Tuples, Basic Tuple Operations, Indexing and Slicing in Tuples,Built-In Functions Used onTuples, Relations between Tuples and Lists, Relations between Tuples and Dictionaries, Tuple Methods, Using zip() Function, Sets, Set Methods, Frozenset.

UNIT - III   [15 Hours]
Files: Types of files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files,The Pickle module, Reading and writing CSV files, **Object-Oriented Programming:** Classes and Objects, Creating Classes in Python, Creating Objects in Python, The Constructor Method, Classes with Multiple Objects, Class Attributes versus Data attributes, Encapsulation, Inheritance, The Polymorphism.

UNIT - IV   [15 Hours]
D**ata Visualization:** Generating Data-Installing Matplotlib, Plotting a Simple Line Graph, Random Walks, Rolling Dice with Plotly. Downloading Data- The CSV File Format, Mapping Global Data Sets: JSON Format, **Working with APIs:** Using a Web API, Visualizing Repositories Using Plotly.

Text Books:
1. Gowrishankar S, Veena A, "Introduction to Python Programming", 1st Edition, CRC Press/Taylor & Francis, 2018. ISBN-13: 978-0815394372. [Unit I&II- 2,3,4,5,6,7,8,9 Unit III-11,12].
2. Eric Matthes, "Python Crash Course- A Hands-On, Project-Based Introduction to Programming", 2nd Edition, No Starch Press, 2019.[Unit III-15, Unit IV-16]
3. Wesley J. Chun, "Core Python Applications Programming", 3rd Edition, Pearson Education, 2016. [Unit IV- 2,5].

Reference Books:
1. Kamthane, A. N., & Kamthane, A.A. , "Programming and Problem Solving with Python", McGraw Hill Education, 2017.
2. Mark Lutz, "Learning Python", 5th edition, Orelly Publication, 2013, ISBN 978- 1449355739.
3. Ljubomir Perkovic, "Introduction to Computing Using Python- An Application Development Focus",Wiley,2012.

CA-C14T: COMPUTER NETWORKS

Total Teaching Hours : 60   No. of Hours / Week: 04

UNIT - I   [15 Hours]
Introduction: Data Communications, Networks, Network Types, Internet History, Network Models: Protocol Layering, The OSI Model, TCP/IP Protocol Suite, Introduction to Physical Layer: Transmission Impairments, Data Rate Limits, Performance, Introduction to Data-Link-Layer: Link-Layer Addressing, Error Detection and Correction: Block Coding, Cyclic Codes, Checksum

UNIT - II   [15 Hours]
Data Link Control: Data-Link Layer Protocols, HDLC, Point-To-Point (PPP), Media Access Control (MAC): ALOHA, CSMA, CSMA/CD, CSMA/CA, Reservation, Polling, Token Passing, FDMA, TDMA, CDMA

UNIT - III   [15 Hours]
Introduction to Network Layer: Network-Layer Services, Packet Switching, Network-Layer Performance, IPV4 Addresses, Network Layer Protocols: Internet Protocol (IP), ICMPv4, Mobile IP, Unicast Routing: Routing Algorithms, Unicast Routing Protocols, Next Generation IP: IPv6 Addressing

UNIT - IV   [15 Hours]
Introduction to Transport Layer: Introduction, Transport-Layer Protocols, Transport-Layer Protocols: User Datagram Protocol, Transmission Control Protocol: TCP Services, TCP Features, Segment, A TCP Connection, TCP Congestion Control, Flow Control, Error Control, Application Layer: WWW, E-MAIL, Domain Name System (DNS), Quality of Service: Flow Control To Improves QoS, Integrated Services

Text Books:
1. Behrouz A. Forouzan, "Data Communications and Networking", 5th Edition, McGraw Hill Education, 2013.

Reference Books:
1. Andrew S. Tanenbaum, David J. Wetherall, "Computer Networks", 5th Edition, Prentice Hall, 2011.
2. Larry L. Peterson and Bruce S. Davie, "Computer Networks A System Approach", 5th Edition, MKP, 2012.
3. James F. Kurose , Keith W. Ross, " Computer Networking, A Top-Down Approach", 5thEdition, Pearson, 2012.

Web Resources:
1. https://www.geeksforgeeks.org/computer-network-tutorials/
2. https://codescracker.com/networking/
3. https://youtube.com/playlist?list=PLxCzCOWd7aiGFBD2-2joCpWOLUrDLvVV_

CA-C15P: PYTHON PROGRAMMING LAB

1. Write a program to demonstrate basic data type in python
2. Create a list and perform the following methods
   1) insert()   2) remove()   3) append()
   4) len()   5) pop()   6) clear()
3. Create a tuple and perform the following methods
   1) Add items   2) len()   3) check for item in tuple   4)Access items
4. Create a dictionary and apply the following methods
   1) Print the dictionary items   2) access items   3) use get()
   4)change values   5) use len()
5. Write a program to create a menu with the following options
   1. TO PERFORM ADDITITON   2. TO PERFORM SUBTRACTION
   3. TO PERFORM MULTIPICATION   4. TO PERFORM DIVISION
   Accepts users input and perform the operation accordingly. Use functions with arguments.
6. Write a python program to print a number is positive/negative using if-else.
7. Write a program for filter() to filter only even numbers from a given list.
8. Write a python program to print date, time for today and now
9. Write a python program to add some days to your present date and print the date added.
10. Write a program to count the numbers of characters in the string and store them in a dictionary data structure
11. Write a program to count frequency of characters in a given file.
12. Using a numpy module create an array and check the following: 1. Type of array 2. Axes of array 3. Shape of array 4. Type of elements in array
13. Write a python program to concatenate the dataframes with two different objects
14. Write a python code to read a csv file using pandas module and print the first and last five lines of a file.
15. Write a python program which accepts the radius of a circle from user and computes the area (use math module)
16. Use the following data (load it as CSV file) for this exercise. Read this file using Pandas or Nu   mPy or using in-built matplotlib function.

Months	Pen	Book	Marker	Chair	Table	Pen stand	Total units	Total profit
1	2500	1500	5200	9200	1200	1500	21100	211000
2	2630	1200	5100	6100	2100	1200	18330	183300
3	2140	1340	4550	9550	3550	1340	22470	224700
4	3400	1130	5870	8870	1870	1130	22270	222700
5	3600	1740	4560	7760	1560	1740	20960	209600
6	2760	1555	4890	7490	1890	1555	20140	201400
7	2980	1120	4780	8980	1780	1120	29550	295500

8	3700	1400	5860	9960	2860	1400	36140	361400
9	3540	1780	6100	8100	2100	1780	23400	234000
10	1990	1890	8300	10300	2300	1890	26670	266700
11	2340	2100	7300	13300	2400	2100	41280	412800
12	2900	1760	7400	14400	1800	1760	30020	300200

a. Get total profit of all months and show line plot with the following Style properties
   Generated line plot must include following Style properties: –
   - Line Style dotted and Line-color should be blue
   - Show legend at the lower right location.
   - X label name = Months
   - Y label name = Sold units
   - Line width should be 4

b. Display the number of units sold per month for each product using multiline plots. (i.e., Separate Plotline for each product.

c. Read chair and table product sales data and show it using the bar chart.
   - The bar chart should display the number of units sold per month for each product. Add a separate bar for each product in the same chart.

d. Read all product sales data and show it using the stack plot

CA-C16P: COMPUTER NETWORKS LAB

1. Execute the following commands:
   arp, ipconfig, hostname, netdiag, netstat, nslookup, pathping, ping route, tracert
2. Study of different types of network cables.
3. Practically implement the cross-wired cable and straight wired cable using crimping tool.
4. Study of network IP address configuration: (Classification of address, static and dynamic address)
5. Study of network IP address configuration: (IPv4 and IPv6 , Subnet, Supernet)
6. Study of network devices: (Switch, Router, Bridge)
7. Configure and connect the computer in LAN.
8. Block th e website using "Windows Defender Firewall" in windows 10.
9. Share the folder in a system, and access the files of that folder from other system using IP address .
10. Share the printer in Network, and take print from other PC.
11. Configuration of wifi hotspot, and connect other devices (mobile / laptop).
12. Configuration of switches.
13. Configuration of I/O box fixing.
14. Making your own patch cord.
15. Configuration of VLAN using Packet Tracer/ GNS3
16. Configuration of VPN using Packet Tracer/ GNS3

References:
1.Paul Browning, "101 CompTIA Networs+ LABS", Reality Press Ltd, 2018.

Web References:
1.youtube.com/watch?v=rurs7cdT5cc
2.https://www.youtube.com/watch?v=_IOZ8_cPgu8
3.https://www.alphr.com/block-websites-windows/