WEST BENGAL STATE COUNCIL OF TECHNICAL & VOCATIONAL EDUCATION AND SKILL DEVELOPMENT
(A Statutory Body under West Bengal Act XXVI of 2013)
(Technical Education Division)
Karigari Bhavan, 4th Floor, Plot No. B/7, Action Area-III, Newtown, Rajarhat, Kolkata–700 160

WBSCTVESD Curriculum for Diploma Courses in Engineering and Technology

Semester – III
(Cyber Forensics and Information Security Engineering)

3rd Semester Cyber Forensics and Information Security Engineering								
Sl. No	**Code No.**	**Course Title**	**Hours per week**				**Credits**	**Marks**
			L	**T**	**P**	**Contact Hours**		
1.	CFIS201	C Programming and Data Structures	5	0	0	5	4	100
2.	CFIS203	Operating Systems	4	0	0	4	3	100
3.	CFIS205	Discrete Structures	3	0	0	3	3	100
4.	CFIS207	Computer System Organization	3	0	0	3	3	100
5.	CFIS209	Data Communications and Networking	3	0	0	3	3	100
6.	CFIS211	C Programming and Data Structures Lab	0	0	5	5	2	100
7.	CFIS213	Operating Systems Lab	0	0	4	4	2	100
8.	CFIS215	Data Communications and Networking Lab	0	0	4	4	2	100
9.	CFIS-SI-201	Summer Internship-I (4 weeks) after 2nd Semester	0	0	0	-	1	100
		Total	18	0	13	31	23	900

Detailed Curriculum Content for Semester-III

Syllabus for C Programming and Data Structures

Course Title	**C Programming and Data Structures**
Course Code: CFIS 201 (Theory)	Semester: Third
Duration: Sixth Months	Maximum Marks:100
Teaching Scheme	Examination Scheme
Theory: 5 hrs./week	Mid Semester Test: 20 Marks, Quizzes, Viva-voce, Assignment: 10 Marks
Total hours: 80	Class Attendance: 10 Marks
Credit: 4	End Semester Exam.: 60 Marks
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately.	
Pre-Requisites: Interaction with DOS / Windows / Linux Operating System. Ability to develop logic / flow of simple problems.	

Course Objectives:

- To study the structured programming concept.
- To familiarize with abstract data types.
- To study Looping and Branching.
- To acquaint students with principles of algorithms.
- To study subscripted variables and user defined data types.
- To study user defined functions.
- To study pointers in depth.
- To study formatted and unformatted files.
- To develop skills in selecting or designing and implementing appropriate data structures in developing software to solve problems.
- To acquaint students with principles of algorithms.
- To familiarize with control and data structures of C programming language, and abstract data types.

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

- Describe the concepts of constants, variables, data types and operators.
- Develop programs using input and output operations.
- Implement programs using different looping and branching statements.
- Write programs based on arrays and strings handling functions.
- Write programs using user-defined functions, structures and union.
- Write programs using C pointers.
- Use formatted and unformatted files to store and access data.
- Demonstrate the abstract properties of various data structures such as stacks, queues, lists, and trees.
- Use various data structures effectively in application programs.
- Trace and code recursive functions.
- Demonstrate various sorting and searching algorithms

Course Content

Unit-1 5 hours

1. Introduction to C programming

1.1. Brief introduction to components of computer systems (disks, memory, processor, where a program is stored and executed, operating systems, compiler, linker and loader etc.)

1.2. Idea of Algorithm: Steps to solve logical and numerical problems. Representation of Algorithm: Flowchart / Pseudo-code with examples, How to write programs from algorithms

1.3. History of C, Advantages of Structured Program, Files (source, header, object, binary executable) used in C, Characteristics of C.

1.4. C character set, Tokens, Constants, Variables, Keywords, Data types used in C, memory locations, Syntax and Logical Errors in compilation

1.5. C operators (arithmetic, logical, assignment, relational, unary, binary, ternary, increment and decrement, conditional, bit-wise, special, comma, sizeof, postfix, prefix etc.), Operator precedence, Associativity of operators, Type conversion, Typecasting.

1.6. Formatted input, Formatted output.

Unit-2 7 hours

2. Decision Control and Looping Statements

2.1. Decision making and branching statements, if statements (if, if-else, else-if ladder, nested if-else), Conditional if-else statement using ternary operator, Switch-case statement.

2.2. Iterative / Loop statements, Entry controlled & exit controlled loop structures and their differences, while, do-while, and for loop structures, break and continue statements, nested loop structures.

Unit-3 5 hours

3. Principles of Programming and Analysis of Algorithms

3.1. Algorithm

3.2. Time and Space Complexity

3.3. Big-oh (O), Big-omega (Ω) and Big-theta (Θ) Notations.

Unit-4 **7 hours**

4. Arrays and Strings

4.1. Advantages of subscripted variables / arrays, Declaration and initialization of one dimensional, two dimensional and character arrays, Accessing array elements.

4.2. Declaration and Initialization of a variable as a string, String handling operations using standard library functions (strlen (), strcpy (), strcat (), strcmp ()), String operations to extract substring from left, right, middle of a string, Replacement of string characters, Concatenation of two strings.

Unit-5 **7 hours**

5. Functions

5.1. Introduction to functions, Need of functions, Prototype declaration, Scope and lifetime of variables, Defining functions, Passing parameter types, Function call (call by value, call by reference), Return values.

5.2. Storage classes, Category of functions (No argument No return value, No argument with return value, Argument with return value), Recursion and use of memory stack.

Unit-6 **7 hours**

6. Pointers

6.1. Understanding pointers, Declaring and Accessing pointers, Null Pointers, Generic Pointers, Dangling Pointer

6.2. Passing arguments to function using pointers, Pointers and arrays, Passing an array to a function, Array name and Pointer.

6.3. Pointers and Strings, Array of pointers.

6.4. Memory usage, Dynamic memory allocation

Unit-7 **5 hours**

7. Structures and Unions

7.1. Structures: Defining structure, Declaring and accessing structure members, typedef declaration, Initialization of structure, Arrays of structure

7.2. Unions: Defining union, Declaring and accessing union members, Initialization of union, Differences between structures and unions.

Unit-8 **1 hours**

8. Pre-processor Directives

8.1. Introduction, Types of pre-processor directives, Macros, Rules for using macros

Unit-9 **3 hours**

9. Files

9.1. Introduction to file and its types, Different modes for opening files, Using formatted and unformatted files in C, Read data from files, Writing data to files

Unit-10 **4 hours**

10. Introduction to Data Structure

10.1. Data Representation

10.2. Abstract data Types

10.3. Data Structure and Structured Types

10.4. Atomic Type, Difference between Abstract Data Types and Data Structures

10.5. Data Types: Linear data type, Non- Linear data type, Primitive data type, Non primitive data type

Unit-11 **4 hours**

11. Stacks

11.1. Introduction

11.2. Primitive operations of stacks

11.3. Representation of Stacks through Arrays

11.4. Application of Stacks of in Infix-to-Postfix Transformation, Evaluation of Postfix Expressions

Unit-12 **4 hours**

12. Queues

12.1. Introduction

12.2. Representation of Queues

12.3. Operations on queue: Searching, Insertion, Deletion.

12.4. Circular Queues

12.5. Priority Queue and Dequeue

12.6. Application of Queues

Unit-13 **5 hours**

13. Linked Lists

13.1. Introduction

13.2. Terminologies: Node, Address, Pointer, Information, Next, Null pointer, Empty list etc.

13.3. Operations on list: Searching, Insertion and Deletion

13.4. Doubly linked list and Circular linked list

Unit-14 **5 hours**

14. Trees

14.1. Introduction to Binary Trees

14.2. Types of Trees

14.3. Definition of Binary Trees

14.4. Binary Tree Traversal: Pre-order, In-order and Post-order

14.5. Operations on Binary Search Tree

Unit-15 **3 hours**

15. Graphs

15.1. Introduction to Graphs

15.2. Terminologies of graph: node (vertices), arcs (edge), directed graph, in-degree, out-degree, adjacent, successor, predecessor, relation, weight, path, length

15.3. Applications of Graph

15.4. Searching methods: Depth-first search and Breadth-first search

Unit-16 **8 hours**

16. Sorting and Searching

16.1. Introduction

16.2. Sorting Algorithms: Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort and Heap Sort.

16.3. Efficiency of Sorting Algorithms

16.4. Searching - Linear Search, Binary Search

16.5. Hashing and Collision Resolution Techniques

Text books:

1. Mastering C, K R Venugopal, Prasad, The McGraw Hill Companies
2. Let Us C, Yashavant Kanetkar
3. The C Programming Language, Kernighan and Ritchie, Prentice Hall of India
4. Programming in ANSI C, E. Balagurusamy, Tata McGraw-Hill
5. C Programming & Data Structures, B. A. Fouruzan and R. F. Gilberg, CENGAGE Learning.
6. Outline of Programming with C, Byron Gottfried, Schaum, McGraw-Hill
7. Data Structures with C (Schaum's Outline Series) Lipschutz Seymour
8. Data Structures, R.S. Salaria, Khanna Book Publishing, New Delhi
9. Data Structures Using C, Reema Thareja, Oxford University Press India.
10. Classic Data Structures, Samanta Debasis, Prentice Hall of India.
11. Fundamentals of Data Structure in C, Horowitz, Ellis, Sahni, Sartaj, Anderson-Freed, Susan, University Press, India.

Reference books:

1. Problem Solving and Programming in C, R.S. Salaria, Khanna Publishing House
2. C Programming Absolute Beginner's Guide, Dean Miller and Greg Perry
3. Data Structures: A Pseudo code approach with C, Richard F. Gilberg, Behrouz A. Forouzan, CENGAGE Learning, India.
4. Data Structures and Algorithms: Concepts, Techniques and Applications, G. A. V. Pai, McGraw-Hill Education, India.

List of open Source software/learning Websites:

https://www.programiz.com/c-programming
https://www.javatpoint.com/c-programming-language-tutorial
https://www.tutorialspoint.com/cprogramming/index.htm
https://www.toptal.com/developers/sorting-algorithms
Online C Compiler IDE (https://www.jdoodle.com/c-online-compiler/)

Syllabus for C Programming and Data Structures Lab

Course Title	**C Programming and Data Structures Lab**				
Course Code: CFIS 211 (Practical)	Semester: Third				
Duration: Sixth Months	Maximum Marks:100				
Teaching Scheme	Continuous Assessment-60			End Semester Assessment-40	
Practical: 5 hrs./week Total hours: 80	Assignments (to be allotted)	Class Performance	Class Attendance	Assignment on the day of Viva-voce	Viva-voce (Before Board of Examiners)
Credit: 2	30	20	10	20	20
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both continuous assessment and end semester Assessment separately.					
Pre-Requisites: Interaction with DOS / Windows / Linux Operating System. Ability to develop logic/flow of simple problems.					

Skills to be developed:

- Use of programming language constructs in program implementation.
- Apply different logics to solve given problems.
- Writing programs using different implementations for the same problem.
- Identify different types of errors as syntax, semantic, fatal, linker & logical.
- Debugging of programs.
- Understanding different steps to develop programs such as - Problem definition. Analysis, Design of logic, Coding, Testing.
- Maintenance (Modifications, error corrections, making changes etc.)

List of Practical:

1. **Formatted output** **6 hours**
   a. Displaying hexadecimal, decimal, octal number format of the entered numbers.
   b. Displaying entered numbers with leading zeros and trailing zeros.
   c. Displaying entered numbers with right and left justification.
   d. Displaying with different formatting specifiers.

2. **Two way and multiway Branching** **8 hours**
   a. To find the greatest / smallest of three numbers.
   b. To display pass class, second-class, distinction according to the marks entered from the keyboard.
   c. To find even or odd numbers.
   d. To display spellings of number 1-10 on entry.
   e. Implementation and displaying the menu to execute 1.ADD 2. SUBTRACT 3. MULTIPLICATION 4. DIVISION using switch case.
   f. To check whether there exist real roots of a quadratic equation and if they exist find them.

3. Loop structure and nested loop structure 12 hours

a. To display our College name twenty times on screen.
b. To demonstrate Continue and Break statements within loop structure.
c. To add first 'n' natural, even, odd numbers using different loop structures.
d. To find GCD, LCM of two integral numbers.
e. To generate a simple number triangle for n rows.
f. To generate the Pascal triangle for n rows.
g. To add the series 1 + (1 + 2) + (1 + 2 + 3) + … + (1 +2 +3 + … +n)
h. To generate all prime numbers within the given range.
i. To find all the Armstrong numbers within 100 to 1000.

4. Arrays and strings 16 hours

a. To find the largest and smallest numbers from array elements. To sort array elements in ascending / descending order.
b. To enter elements for a 3x3 matrix and display them.
c. To calculate addition / subtraction of 2 dimensional matrices.
d. To calculate multiplication of 2 dimensional matrices.
e. To find the number of vowels and consonants in a string.
f. Implementation of strlen(), strcpy(), strcat() and strcmp() functions.
g. To check whether a string is palindrome or not.
h. To replace a specific character/string by another character/string in a multi word string.
i. To make the abbreviated form of a multi word string

5. User defined functions, structures and pointers 12 hours

a. To interchange the biggest and smallest number in to calculate factorial a one dimensional array using function.
b. To calculate the factorial of any given number using recursion.
c. To demonstrate call by reference, call by value.
d. To read and display an integer array using pointer.
e. To read and display a text using a character pointer to a string. Also count the number of characters, words and lines in the text.
f. To read, display, add and subtract two times defined using hour, minutes and values of seconds.
g. To read and display the contents of a structure variable using pointer to a structure

6. Formatted and unformatted files 10 hours

a. Handling with unformatted, formatted files in different operational modes.
b. To count the number characters and number of lines in a file.
c. To copy one file into another by copying one character at a time / multiple characters simultaneously (using fgets() and fputs()).
d. To write records of students to a file using an array of structure and display them accordingly.
e. A text menu driven program to append a record, to edit a particular record, to display a predefined record, to delete a particular record from a previously created student file.

7. Data Structure Implementations 16 hours

a. To write a program to insert (Push) an element into the stack and delete (Pop) an element from the stack using pointers.
b. To write a program to convert an infix expression to a postfix expression.
c. To evaluate a postfix expression.
d. To write a program to insert an element in the queue and delete an element from the queue using pointers.
e. To create a circular queue and add an element and delete an element from a circular queue.
f. To create a doubly linked list and — (a) insert a node in the list (before header node, in between two nodes, end of the list) (b) delete a node from the list (1st node, last node, in between two nodes) (c) Concatenate two lists.
g. To create a circular linked list and insert & delete an element from the list.
h. To write a program to sort a list of numbers using (a) Heap Sort (b) Quick Sort (c) Bubble Sort.
i. To write a program to sort a list of numbers using (a) Insertion Sort (b) Merge Sort (c) Selection Sort.
j. To write a program to create a binary tree and traverse it in pre-order, in-order and post-order form.
k. To write a program to implement linear search and binary search technique.

Syllabus for Operating Systems

Course Title	**Operating Systems (CFIS)**
Course Code: CFIS 203 (Theory)	Semester: Third
Duration: Sixth Months	Maximum Marks:100
Teaching Scheme	Examination Scheme
Theory: 4 hrs./week	Mid Semester Test: 20 Marks, Quizzes, Viva-voce, Assignment: 10 Marks
Total hours: 64	Class Attendance: 10 Marks
Credit: 3	End Semester Exam.: 60 Marks
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately.	
Pre-Requisites: Basic knowledge of Computer Hardware components and Software installation process and the ability to develop logic / flow of simple problems.	

Course Objectives:

- To learn various ideas in implementation of operating systems, particularly LINUX/Windows.
- To understand various options available so as to develop capacity to compare, contrast, evaluate the key trade-offs between different designs choices.
- To familiarize OS Security and Forensics aspects.
- To learn all functionalities of OS in detail.

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

- Describe the important computer system resources and the role of operating system in their management policies and algorithms.
- Understand the process management policies and scheduling of processes by CPU Evaluate the requirement for process synchronization and coordination handled by operating system.
- Describe and analyze the memory management and its allocation policies.
- Identify use and evaluate the storage management policies with respect to different storage management technologies.
- Understand the basic concepts of OS Security and Forensics aspects.

Course Content

Unit-1 6 hours

1. Operating System Overview

1.1. Objectives and Functions of Operating System

1.2. The Evolution of Operating System

1.3. Types of Operating System: Simple Batch System, Multiprogramming Batch System, Multiprocessor System, Desktop System, Distributed Operating System, Clustered System, Real Time Operating System, Handheld System

Unit-2 8 hours

2. Operating System Structures

2.1. System components: Process management, Main memory management, File Management, I/O system management, Secondary storage management.

2.2. Operating system services: User Interface, Program Execution, File System Manipulation, Input / Output Operations, Communication, Resource Allocation, Error Detection, Accounting, Security and protection

2.3. System calls: Uses, Process Control, File Management, Device Management, Information Maintenance, Communication

2.4. Operating system structure: Simple structure, layered, monolithic, microkernel.

2.5. System Boot

2.6. Virtual Machine (Concept)

Unit-3 8 hours

3. Process Management

3.1. Processes: Concept, Process State, Process Control Block.

3.2. Process Scheduling: Scheduling queues, Scheduler, context switch.

3.3. Operations on Processes: creation, termination.

3.4. Inter process communication.

3.5. Classical problems of synchronization, semaphores.

3.6. Threads: Benefits, user and kernel threads.

3.7. Multithreading Models: Many to One, One to One, Many to Many.

Unit-4 8 hours

4. Scheduling

4.1. Scheduling: Objectives, Concept, Criteria, CPU and I/O burst cycle.

4.2. Types of Scheduling: Pre-emptive, Non pre-emptive.

4.3. Scheduling Algorithms: First come first served (FCFS), Shortest job first (SJF), Round Robin (RR), Priority.

4.4. Other Scheduling: Multilevel, Multiprocessor, Real-Time.

4.5. Deadlock: System model, principal necessary conditions, mutual exclusion, critical region.

4.6. Deadlock handling: Detection and Recovery, Prevention and Avoidance.

Unit-5 6 hours

5. Memory Management

5.1. Basic Memory Management –Partitioning, Fixed &Variable.

5.2. Free Space management techniques –Bitmap, Linked List.

5.3. Virtual Memory – Concept, Paging, Page fault, Page Table, Segmentation

5.4. Page Replacement algorithms – FIFO(First in First Out), Optimal Page replacement, LRU (Least recently used)

Unit-6 **8 hours**

6. File System

6.1. File- Concept, Attributes, Operations, Types, Structure.
6.2. Access Methods – Sequential, Direct.
6.3. Swapping and Mounting of File Systems.
6.4. Allocation Methods – Contiguous, Linked, Indexed.
6.5. Directory Structure – Single level, Two level, Tree Structure.
6.6. File System Implementation: VFS, Ext4, NTFS, POSIX, CD/DVD File system
6.7. I/O Devices: Magnetic Tapes, Magnetic Disks, Disk Attachment Technologies, Optical Disks
6.8. Security: Access Control (Windows, Linux), Security Configuration and Maintenance, Intruders and Malicious Software, OS Hardening.

Unit-7 **8 hours**

7. I/O Management

7.1. I/O hardware, polling, interrupts, DMA
7.2. Applications of I/O interface (block and character devices, network devices, clocks and timers, blocking and non-blocking I/O)
7.3. Kernel I/O subsystem: Scheduling, buffering, caching, spooling and device reservation, error handling.

Unit-8 **6 hours**

8. Disk Management

8.1. Disk Structure: SATA, HDD, SSD.
8.2. Disk Scheduling: FCFS, SSTF, SCAN,CSCAN
8.3. Disk Reliability, Disk Formatting, Boot Block, Bad Blocks, RAID concepts.
8.4. Seek Time, Latency Time, Access Time

Unit-9 **6 hours**

9. Case Studies

9.1. General overview of Linux System: System Structure, Operating System Structure
9.2. Introduction to kernel: Kernel data structure, System Administration
9.3. Internal Representation of Files: inode, Structure of regular file, Super block
9.4. OS Security and Forensics (Data Acquisition method): Disk-to-image file, Disk-to-disk copy, Disk-to-Data file, The Sparse copy of a file

Text Books:

1. Silberschatz, Galvin, Gagne Operating System Concepts Wiley Publication
2. Achyut S. Godbole Operating Systems Tata McGraw-Hill
3. D. M. Dhamdhere Operating Systems A Concept-Based Approach Tata McGraw-Hill
4. Operating Systems: Internals and Design Principles by William Stallings, Pearson
5. R.Chopra Operating Systems S.Chand
6. P.B.Prasad Operating Systems Scitech
7. Khurana Operating Systems Vikas

Reference Books:

1. Andrew S.Tanenbaum Modern Operating Systems PEARSON
2. Deitel Deitel Operating Systems, PEARSON

Syllabus for Operating Systems Lab

Course Title	**Operating Systems Lab (CFIS)**				
Course Code: CFIS 213 (Practical)	Semester: Third				
Duration: Sixth Months	Maximum Marks:100				
Teaching Scheme	Continuous Assessment-60			End Semester Assessment-40	
Practical: 4 hrs./week Total hours: 64	Assignments (to be allotted)	Class Performance	Class Attendance	Assignment on the day of Viva-voce	Viva-voce (Before Board of Examiners)
Credit: 2	30	20	10	20	20
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both continuous assessment and end semester Assessment separately.					
Pre-Requisites: Basic knowledge of Computer Hardware components, Software installation process. Fundamental concepts of Data Structures and Operating Systems.					

Course Objectives:

- Describe the basic file system in Linux and its file attributes.
- Appraise different filters, process handling, regular expressions and network handling features using suitable commands.
- Summarize different Linux commands to write Shell Programs.

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

- Understand the Linux environment
- Perform the file management and multiple tasks using shell scripts in Linux environment.
- Demonstrate the basic knowledge of Linux commands and file handling utilities by using Linux shell environment.
- Evaluate the concept of shell scripting programs by using an AWK and SED commands.
- Create the directory, how to change and remove the directory.
- Analyze the process of how the parent and child relationships
- Understand IPC mechanism and its Applications

Unit-1 10 hours

Basic commands

1. Installation of Linux/Windows operating system.
2. Study of logging/logout details.
3. Study of Linux/Windows general purpose utility command list obtained from (man, who, cat, cd, cp, ps, ls, mv, rm, mkdir, rmdir, echo, more, date, time, kill, history, chmod, chown, finger, pwd, cal, logout, shutdown) commands.
4. Study of vi editor.
5. Study of Bash shell, Bourne shell and C shell in Linux operating system. Windows DOS commands
6. Study of Linux/Windows file system (tree structure).
7. Study of .bashrc, /etc/bashrc , Environment variables and Windows Registry.

Unit-2 6 hours

C programs in Linux

1. Write a C program to check whether the given string is palindrome or not using
2. Command line substitution.
3. Write a C program to emulate the LINUX ls-l command.
4. Write a C program to check the given integer is prime or not.

Unit-3 12 hours

Shell scripts and sed

1. Shell script program to check whether given file is a directory or not.
2. Shell script program to count number of files in a Directory.
3. Shell script program to copy contents of one file to another.
4. Create directory, write contents on that and Copy to a suitable location in your home directory.
5. Use a pipeline and command substitution to set the length of a line in file to a variable.
6. Write a program using sed command to print duplicated lines of Input.

Unit-4 6 hours

grep, awk

1. Write a grep / egrep script to find the number of words character, words and lines in a file.
2. Write an awk script to develop a Fibonacci series.
3. Write an egrep script to display list of files in the directory.

Unit-5 4 hours

Searching, Installing, and Removing Tools

1. apt update, apt upgrade
2. apt-cache search and apt show
3. apt install, apt remove –urge
4. dpkg

Unit-6 10 hours

Shell script programming

1. Write a shell script program to check variable attributes of file and processes.
2. Shell Script program to implement read, write, and execute permissions.
3. Shell Script program for changing process priority.
4. Write a shell script to change the ownership of processes.
5. Write a program to send back a process from foreground.
6. Write a program to retrieve a process from background.
7. Write a program to create a Zombie process.
8. Write a program to create a child process and allow the parent to display “parent” and the child to display “child” on the screen.

Unit-7 10 hours

Interprocess Communication

1. Write a C program that implements a producer-consumer system with two processes (Pipes / FIFO queue concept).
2. Write client and server programs (using c) for interaction between server and client processes using Linux Domain sockets. (Using Semaphores).
3. Write client and server programs (using c) for interaction between server and client processes using Internet Domain sockets.
4. Write a C program that illustrates two processes communicating using shared memory.

Unit-8 6 hours

Linux / Windows Virtualization

1. Installation of VirtualBox (VMWare) on a PC having other operating system.
2. Installation of Linux packages and Windows Applications.

Text and Reference Books:

1. Maurice J. Bach The design of the Unix Operating System PHI
2. Sumitabha Das UNIX Concepts and Applications McGraw-Hill
3. B.M.Harwani Unix and Shell Programming OXFORD
4. Subhash UNIX System Programming PEARSON
5. Sobell Practical Guide to Linux
6. Commands, Editors, and Shell Programming, PEARSON
7. UNIX Programming A Ramasatish

Syllabus for Discrete Structures

Course Title	**Discrete Structures**
Course Code: CFIS 205 (Theory)	Semester: Third
Duration: Six Months	Maximum Marks: 100
Teaching Scheme:	Examination Scheme:
Theory: 3 hrs./week	Mid Semester Test: 20 Marks Quizzes, Viva-voce, Assignment: 10 Marks
Credit : 3	Class Attendance: 10 Marks
Total hours: 48	End Semester Exam. : 60 Marks
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately.	
Pre Requisites: Basic concepts of 1st year Engineering Mathematics-I and Engineering Mathematics-II	

Course Objectives:

Students can develop their ability to understand and create mathematical arguments. Discrete structures provide the mathematical foundations for many subjects to be studied in this course and it is the gateway to move into the depth of core mathematical sciences of different subjects. This course covers the basic concepts of discrete and combinatorial mathematics used in Cyber Forensics and Information Security, Computer Science and other disciplines that involve formal reasoning. The topics include Mathematical logic, Set Theory, Relations, Functions, Matrix, Probability, Combinatorics, Graph theory and Trees.

Course Outcomes: After completion of the course students will be able to learn the following major themes:

- Mathematical reasoning: Students are expected to use mathematical reasoning in order to read, comprehend, and construct mathematical arguments. Students will learn basic concepts of mathematical logic and proof.
- Combinatorial analysis: Students will count or enumerate objects and perform combinatorial analysis.
- Discrete structures: Students will learn the basic concepts of sets, permutations, relations, graphs, trees and finite state machines. Students will represent discrete objects and relationships using abstract mathematical structures.
- Algorithmic thinking: Students will verify whether an algorithm works well and perform analysis in terms of memory and time.
- Applications and modeling: Discrete mathematics has been used in numerous applications. Students will formulate and model problems with the concepts and techniques of discrete mathematics.

Course Content

Unit-1 **6 hours**

1. Mathematical Logic

1.1 Statement and Notation

1.2 Connectives: Negation, Conjunction, Disjunction, Statement Formulas and truth Tables, Conditional and Biconditional, Well-formed Formulas, Tautologies, Equivalence of Formulas, Duality Law, Tautological Implications

1.3 Normal Forms: Disjunctive and Conjunctive Normal Forms.

1.4 The Theory of Inference for the Statement Calculus – validity using Truth Table, Rules of Inference, Consistency of Premises and Indirect method of proof

1.5 Predicate Calculus: Rules of precedence of logical operators Predicate (propositional) functions

Unit-2 **3 hours**

2. SET Theory

2.1 Concept of SETS: Notation, Subset, Superset, Empty set, Universal set

2.2 Operation on SETS: Union, Intersection, Complementation, Difference, Symmetric difference, Problems relating simple set identities

2.3 Definition of power set: Cartesian product of finite number of sets

2.4 Cardinality of a set, Finite and Infinite sets

Unit-3 **4 hours**

3. Relation

3.1 Relation between two sets: Binary relation as a subset of Cartesian product

3.2 Reflexive, symmetric & transitive relations – Examples

3.3 Equivalence relation – Examples

3.4 Partition – problems

Unit-4 **2 hours**

4. Functions

4.1 Functions: Definition of function – Domain, Co-domain & Range of a function

4.2 Injective, Surjective and Bijective functions – Related problems

Unit-5 **4 hours**

5. Matrix

5.1 Eigenvalues and Eigenvectors: Definition, Characteristic values and Characteristic vectors of a Matrix

5.2 Characteristic equation: Relation between Characteristic Roots and Characteristic Vectors

5.3 Nature of Characteristic Roots of special type of Matrices– The Process of finding the Eigenvalues and Eigenvectors –Theorems and Related problems.

Unit-6 **12 hours**

6. Combinatorics

6.1 Pigeon-hole principle and its generalization with applications to a variety of problems.

6.2 Principle of Inclusion and Exclusion: Statement of the principle: Set theoretic problems relating to principles of inclusion and exclusion

6.3 Mathematical Induction: Concept of Induction – Statement of the principle of Mathematical Induction

6.4 Application of the principle of Induction in various problems

6.5 Recurrence Relation: Definition, Examples (Fibonacci series etc.) – Linear recurrence relations with constants coefficients – Homogeneous solutions, Particular solutions – Total solutions – Problems

6.6 Probability: Random Experiment, Trial, Sample Point and Sample Space, Definition of an Event, Mutually Exclusive, Exhaustive, Independent and Equally Likely Events. Definition of the Probability-Classical and Relative Frequency approach to Probability, their Demerits and Axiomatic Approach to Probability. Properties of Probability based on Axiomatic Approach, Conditional Probability, Bayes Theorem and Its Applications.

6.7 Random Variable: Definition of Discrete Random Variables, Probability Mass Function, Continuous Random Variable, Probability Density Function Illustrations of Random, Variables and Its Properties, Expectation of a Random Variable and Its Properties-Moments

Unit-7 **10 hours**

7. Graph Theory

7.1 Introduction: Definition of a graph, Directed & Undirected graphs (Definition & Example); Basic Terminology: Loop, Multigraph, Pseudo graph, Simple graph, Finite and Infinite graphs-Definition and examples;

7.2 Subgraph Spanning subgraph-Removal of a Vertex and an edge-Induced subgraph- Definition &Example;

7.3 Graph Isomorphism – Definition and Examples;

7.4 Walk, Paths, length and Circuits –Definition and Examples;

7.5 Euler graphs –Euler path, Euler Circuit – Definition and examples;

7.6 Hamiltonian Graphs – Definition and example – Problems

7.7 Sequential Representation of Graphs

7.8 Linked Representation of Graphs

7.9 Traversal of Graphs

7.10 Shortest Path, Shortest path algorithm – Dijkstra's algorithm, Floyd-Warshall algorithms

7.11 Graph Search: BFS, DFS

Unit-8 **7 hours**

8. Tree

8.1 Definition & properties of trees – Distance & Centre in a tree;

8.2 Rooted tree- Co Tree-definition & example;

8.3 Binary trees –Definition & Properties, Path length, Binary tree representation of general trees- Problems, Traversal.

8.4 Spanning tree – Branch of tree- chord- definition & properties; Spanning tree in a weighted graph

8.5 Algorithm for constructing Spanning tree – Graph theoretic algorithms – Minimal Spanning tree algorithm – Kruskal's Algorithm –Problems

Text books:

1. B. Kolman, R. C. Busby, S. C. Ross and N. Rehman: Discrete Mathematical Structures
2. Graph Theory with Applications to Engineering and Computer Science by Narsingh Deo
3. Discrete Mathematical Structures with Applications to Computer Science, J.P Tremblay & R. Manohar, McGraw Hill
4. Swapan Kumar Chakraborty & BikashKanti Sarkar, Discrete Mathematics, OXFORD
5. T. Sengadir, Discrete Mathematics and Combinatorics, PEARSON
6. Lipschutz& Lipson, Discrete Mathematics, McGraw Hill
7. Iyengear, Discrete Mathematics, Vikas

Reference books:

8. Discrete Mathematics and its Applications, Kenneth H Rosen, McGraw-Hill
9. Discrete and Combinatorial Mathematics, Ralph P. Grimaldi & Ramana, Pearson
10. Graph Theory with Application, Dr. Sukhendu Dey, SPD
11. Graph Theory, Schaum's outlines, V.K. Balakrishnan, TMH

Syllabus for Computer System Organization

Course Title	**Computer System Organization**
Course Code: CFIS 207 (Theory)	Semester: Third
Duration: Sixth Months	Maximum Marks:100
Teaching Scheme	Examination Scheme
Theory: 3 hrs./week	Mid Semester Test: 20 Marks, Quizzes, Viva-voce, Assignment: 10 Marks
Total hours: 48	Class Attendance: 10 Marks
Credit: 3	End Semester Exam.: 60 Marks
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately.	
Pre-Requisites: Basic knowledge of computer hardware and software is helpful. Basic knowledge of number system is required.	

Course Objectives:

- To have a thorough understanding of the basic structure and operation of a digital computer, its architectures and computational designs.
- To understand the structure and operational concept of computer system.
- To learn the how numbers represented in computers and process them.
- To understand memory system and access mechanism of IO devices.
- To learn pipelining and parallel processing.

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

- Have a good understanding of functioning of computer system as such and its various sub-components. Student will be able to understand computing requirement for a specific purpose, analyze performance bottlenecks of the computing device and choose appropriate computing device for a given use case.
- Understand a computer system that has hardware and software components, which controls and makes them useful.
- Understand the fixed and floating point number representation in computer.
- Understand how arithmetic operation will be performed in computer system.
- Acquire knowledge on Cache and virtual memory.
- Understand Interrupt and DMA access.
- Acquire knowledge on RISC and CISC architecture.
- Understand how pipelining and parallel processing improves the performance of computer system.

Course Content

UNIT-1 **9 hours**

1. Basics of Computer system

1.1 Structure of Computers: Computer Functional units, Von-Neumann architecture and its bottleneck, Bus structures, Basic Operational Concepts, Data representation (Fixed and Floating point), Error detecting codes.

1.2 Register Transfer and Micro Operations: Register transfer, Bus and memory transfers, Arithmetic micro-operations, Logic micro-operations, Shift micro-operations, and Arithmetic logic shift unit.

UNIT-2 **8 hours**

2. Introduction to Microprocessor Architecture

2.1 Difference between Computer Architecture and Organization, Instruction Set Architecture design principles from programmer's perspective. One example of microprocessor (Intel, ARM, etc).

UNIT-3 **7 hours**

3. Assembly Language Programming

3.1 Simple programs, Assembly language programs involving logical, branch and call instructions, sorting, evaluation of arithmetic expressions, string manipulation, assembler directives, procedures and macros.

UNIT-4 **14 hours**

4. Memory and Digital Interfacing

4.1 Addressing and address decoding, interfacing RAM, ROM, EPROM, programmable peripheral interface, various modes of operation and interfacing to processor, interfacing keyboard, displays, etc.

4.2 Memory and I/O: Memory Hierarchy model and comparison on cost, speed and size; Cache memory, Locality of Reference, Mapping Techniques, Hit ratio, Replacement algorithms; Concept of virtual memory technique, address translation method, TLB; Different methods of IO access mechanism; Programmed IO or Status check IO, Interrupt Mechanism, DMA data transfer, IO processor; Different types of interrupt, Priority interrupt, Simultaneous interrupt; DMA transfer modes – Burst mode, Cycle stealing mode. I/O handling in Assembly Level Programming, Programmable Timers, Programmable Interrupt Controller, Programmable DMA Controller.

UNIT-5 **10 hours**

5. Control Unit and Parallel Processing

5.1 Micro Programmed Control: Control memory, Address sequencing, and design of control unit.

5.2 Computer Arithmetic: Addition and Subtraction, Multiplication and Division algorithms, Floating-point arithmetic operation, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline Vector Processing, Array Processors, Standards of representation of Integers and Floating Point numbers.

Text Books:

1. Computer System Architecture, M. Moris Mano, Pearson/PHI, India.
2. Computer Organization, Carl Hamacher, Zvonks Vranesic, SafeaZaky, McGraw-Hill
3. Computer Organization and Architecture, Stallings, Pearson

Reference Books:

1. Microprocessors Interface, Douglas V.Hall, Tata McGraw-Hill.
2. Advanced Microprocessors and Peripherals- Architecture, Programming and interfacing, A.K.Ray, K. M. Bhurchandi, Tata McGraw-Hill, New Delhi, India.
3. Computer Organization and Design: A Hardwar/Software Interface (MIPS Edition) by Patterson and Hennessy

Syllabus for Data Communications and Networking

Course Title	**Data Communications and Networking**
Course Code: CFIS209 (Theory)	Semester: Third
Duration: Six Months	Maximum Marks: 100
Teaching Scheme:	Examination Scheme:
Theory: 3 hrs./week	Mid Semester Test: 20 Marks Quizzes, Viva-voce, Assignment: 10 Marks
Credit : 3	Class Attendance: 10 Marks
Total hours: 48	End Semester Exam. : 60 Marks
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately.	
Pre-Requisites: Understand the different components of a computer and basic ideas of Digital system	

Course Objectives:

- To understand the usefulness of Computer Networking and its features
- To familiarize with types of Cables, NIC, NOS, Repeater, Hub, Bridge, Switch, Router, Gateway
- To understand the functioning of computer networks and popular networking protocols
- To learn in detail basic models of networking -ISO OSI and TCP/IP

Course outcomes: The students will be able to:

- Understand the benefits of network, Distinguish between Network classifications
- Understanding of computer networks, issues, limitations, options available.
- Understanding of the care that needs to be taken while developing applications designed to work over computer networks
- Describe different types of Topology, Describe different types of Network devices, Compare different transmission media.
- Able to configure basic LAN and connect computers to it
- Compare OSI and TCP/IP model and Configure TCP/IP.

Course Content

Unit-1 **8 hours**

1. Introduction to Data Communications and Networking

1.1. Definition, advantages of computer networks, important features of computer networks (reliability, speed, cost-effectiveness, security, Modes of Data Communication, interoperability, scalability, high bandwidth), standards and protocols

1.2. Elements of a Network: Cables, NIC, Network Operating System, Repeater, Hub, Bridge, Switch, Router, Gateway

1.3. Types of Networks: Communication-Based classification (Broadcast Networks, Point-to-Point Networks), Distance-Based Classification (LAN, MAN, WAN), Topology-Based Classification (Bus, Star, Ring, Tree, Mesh, Star bus, Star ring), Architecture-Based Classification (Peer-to-Peer, Clint/Server), Protocol-Based Classification (Ethernet, FDDI)

Unit - 2 **6 hours**

2. Network Reference Models

2.1. Introduction to Layered Architecture, Need for layering Architecture

2.2. OSI Reference Model, Layers in the OSI model

2.3. TCP/IP Reference Model, Layers of the TCP/IP Model

2.4. Comparison of OSI and TCP/IP Models

Unit - 3 **8 hours**

3. Physical Layer

3.1 Introduction to Physical Layer, Tasks of Physical Layer

3.2 Data and Signals: Analog and Digital Signals, Bit rate, Transmission of Digital Signals, Attenuation, Distortion, Noise, Noiseless Channel (Nyquist Bit Rate), Noisy Channel (Shannon Capacity), Bandwidth, Throughput, Latency(Delay), Jitter.

3.3 Analog-to-Digital Conversion: PCM, DM, Transmission Modes (Parallel, Serial)

3.4 Digital-to-Analog Conversion: ASK, FSK, PSK, Coding Scheme (Line Coding, Block Coding)

3.5 Analog-to-Analog Conversion: AM, FM, PM

3.6 Transmission Media: Guided Media, Unguided Media

3.7 Switching: Circuit Switching, Packet Switching, Message Switching

Unit - 4 **7 hours**

4. Data Link Layer

4.1 Introduction to Data Link Layer, Functions of Data Link Layer, Flow Control Mechanisms and Data Link Layer Protocols.

4.2 Multiple Access Protocol: Concepts of ALOHA, Collisions, Collision Domains, Broadcast Domains, Collision Detection and Avoidance, CSMA, CSMA / CD, CSMA/CA

4.3 Layer 2 switching: VLAN, Trunking, STP, MAC based security, ARP Learning

Unit - 5 **8 hours**

5. Network Layer

5.1 Introduction to Network layer, Role of Network layer

5.2 Routing: Types of Routing, Routing Algorithms (Dijkstra's, Shortest Path, Distance Vector, Link state), Routing Protocols (RIP, OSPF), Other Routing Protocols (ICMP, ARP, RARP, DHCP)

5.3 IP address: Classes of IP address, Subnetting, Supernetting, CIDR, Subnet Masks, Private IP, Advantages of IPv6 over IPv4.

Unit - 6 **4 hours**

6. Transport Layer

6.1 Introduction to Transport Layer, End-to-End Connection, QoS, Flow Control, Multiplexing, Ports and Sockets.

6.2 Connection-Oriented and Connectionless Service, Comparison TCP and UDP

Unit - 7 **7 hours**

7. Session, Presentation and Application Layers

7.1 Session Layer: Session Layer Functions, Session Layer Protocols (RPC, NetBIOS)

7.2 Presentation Layer: Functions of Presentation Layer, Presentation Layer Protocols (FTP, Telnet)

7.3 Application Layer: Functions of Application Layer, Application Layer Protocols (HTTP, HTTPS, DNS, SMTP)

Text and Reference Books:

1. Data communication & Networking by Bahrouz Forouzan, McGrawHill
2. Computer Networks by Andrew S. Tanenbaum, Pearson
3. Data and Computer Communications by William Stallings, Pearson
4. A Course in Computer network, DR. Sanjay Sharma, KATARIA
5. N. Olifer, V. Olifer Computer Networks Principles, Technologies and protocols for network Design, Wiley
6. Dostalek Understanding TCP/IP, SPD
7. Data Communication and Computer Networks, Agarwal, Tiwari, Vikas
8. Data Communication and Networks, Bhushan Trivedi, Oxford Press
9. TCP/IP Protocol Suite, Bahrouz Forouzan, McGraw-Hill
10. Computer Networking, Schaum's Outlines, Tata McGraw-Hill,
11. Networking A Beginner's Guide, Bruce Hallberg, McGraw-Hill
12. Elements of Computer Networking: An Integrated Approach (Concepts, Problems and Interview Questions), Narasimha Karumanchi, Career Monk Publications

Syllabus for Data Communications and Networking Lab

Course Title	**Data Communications and Networking Lab**				
Course Code: CFIS 215 (Practical)	Semester: Third				
Duration: Sixth Months	Maximum Marks:100				
Teaching Scheme	Continuous Assessment-60			End Semester Assessment-40	
Practical: 4 hrs./week Total hours: 64	Assignments (to be allotted)	Class Performance	Class Attendance	Assignment on the day of Viva-voce	Viva-voce (Before Board of Examiners)
Credit: 2	30	20	10	20	20
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both continuous assessment and end semester assessment separately.					
Pre-Requisites: Understand the different components of a computer and basic ideas of Digital system					

Skills to be developed:

- Concepts of networking and its components
- Concepts of OSI and TCP/IP model
- Detailed concepts and practices of Layer-2 and Layer-3 networking systems
- Case study of a practical network setup of a model office

List of Practical:

Sl. No.	List of Practical
1.	Study different types of network cables and Connectors. Then practically make the Cross-over Cable and Straight cable using RJ45 connectors, Crimping tools and LAN Tester. 8 hours
2.	Learn IP Addressing scheme, Subnet masking and Subnetting. Then implement static IP setting, subnet mask, Gateway and DNS configuration on Linux/Windows machine in a network system. 8 hours
3.	Install and run the following applications in a network system and get knowledge: (i) FTP (ii) SSH (iii) PuTTY (iv) Remote Desktop 8 hours

4	a) Locate the MAC address of computer. b) Use step by step method for File sharing , Printer sharing and Internet sharing in a network system c) Familiarization with loop back testing d) Familiarization with the concept of socket and write a socket program 10 hours
5	Basic TCP/IP utilities and commands. (e.g.: ping, ipconfig, tracert, arp, tcpdump, whois, host, netstat, nslookup) 8 hours
6	Managing of Layer-2 switching: setting of VLAN, Trunking, STP, MAC based security, ARP Learning 10 hours
7	Configure a router (Ethernet & Serial Interface) using router commands including access lists on any network simulator (e.g. GNS3 / Packet Tracer) 6 hours
8	Design and make a small network system using switch with other physical components. Then implement the IP addressing scheme. 6 hours

Text and Reference Books:

1. Networking All - in - One For Dummies, Doug Lowe, Wiley
2. Practical Guide to Advanced Networking, Beasley Jeffrey S, Pearson
3. Practical Networking By Frank J. Derfler; Frank Derfler; Jeff Koch; Frank J., Jr. Derfler; Frank J Derfler, Que Publisher
4. Mastering PC Hardware & Networking by Mittal Ajit, Publisher: Khanna Publishers
5. Cabling The Complete Guide to Copper and Fiber-Optic Networking, Andrew Oliviero Bill Woodward, Wiley Publishing